RESEARCH REPORT

ENSEMBLE II

SDR

HF

AND

LF

+

Device Info

Softrock Lite II Softrock Lite II: Power Supply Band:

Introduction

General Info About the Stage

In this first (and following) stages, the builder should remember that one of the most common causes of errors is soldering. It pays to review materials on soldering, get help from Elmers, or whatever you can do to make your solder joints as clean and properly conductive as possible!

The second most common cause of errors is installation of the WRONG component and/or installing the component in the wrong ORIENTATION. The old rule of "measure twice, cut once" clearly applies to this project. Be especially careful and beware that it is very easy to install the wrong resistor depending entirely in color codes. While color codes are helpful in initially sorting resistors out, it is imperative that you validate that you have the correct resistor by double checking with your ohmmeter. While the ohmmeter reading will never be the exact value, for most of the resistors in this kit, the ohmmeter will get you to within 1% (a very few some are within 5%) of the stated value

The remaining one-tenth of one percent of the causes of errors is the defective component - most suspect the component immediately; the intelligent rarely look first at possible component failure.

Theory of Operation

This stage provides the +5 volt power rail for the radio. The incoming voltage (from 9 - 12 Vdc) is regulated by U1 to a nominal 5 Vdc (4.5 - 5.1 Vdc range). D1 serves to protect the circuit from accidentally reversed polarity.

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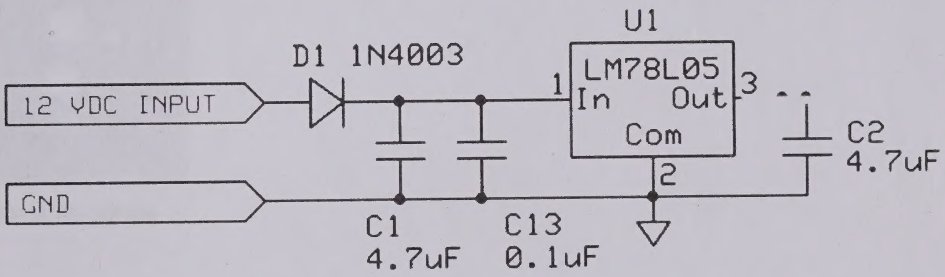
Stage Schematic



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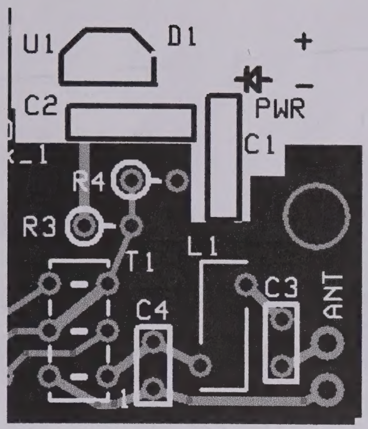
Board Layouts

Board Top



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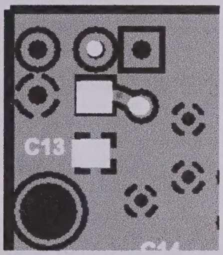
Board Bottom



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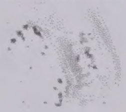
Power Supply Bill of Materials (20m band option)

Check	Type	Category	Component	Count	Marking	Image
☐	Capacitor	SMT 1206		1	(smt) black stripe	
☐	Capacitor	Ceramic		2	475	
☐	Diode	Axial		1	1N4003	

Installing and using HDSDR

HDSDR is a derivative of Alberto's Winrad, parts of these notes apply to this and any other derivatives.
HDSDR is still being developed, new features added. We are promised a version 3 at some time.
My experience covers SDRs using the Si570 like the Softrock.
HDSDR may be used with the Funcube and RTL dongles.
Look here for help with other radios. http://www.hdsdr.de/hardware.html

Softrock:- you need CFGSR and the USB driver but may well already have them. Driver** http://www.pe0fko.nl/SR-V9-Si570/#install **Read carefully. CFGSR Current version 2.6 which you download from** http://home.ict.nl/~fredkrom/pe0fko/CFGSR/ **with automatic installer and new guide on that web page. (Click on "msi" ....download the correct msi file...) ***Note instructions on that page.***
My screenshots show an earlier version but the tabs shown are almost identical.

Download HDSDR from here *http://www.hdsdr.de/index.html*
While you are there read the other pages, note the link to Alberto's original help and You Tube.

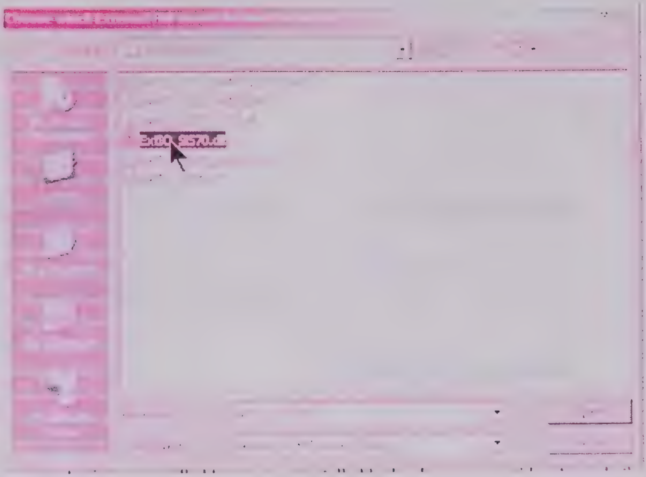
Execute the installation.
Later versions of Windows have security features that make altering the contents of "Program Files" difficult. A way round this might be to change the default and install HDSDR somewhere different "C\HDSDR" perhaps.
Note the folder where it installs, you will need to find it in order to place a DLL file in there.

The paragraph below is to install Softrock type SDRs, look here *http://hdsdr.de/hardware.html* ***for DLLs and instructions for use with many other radios, SDR and conventional .***

Softrocks and others using the USB ATTiny controller.
Winrad and its derivatives need **ExtIO_Si570.DLL** to be placed in the program folder. There is a shortcut to it in the CFGSR Start Menu folder. COPY it to the Program folder. (Drag with RIGHT mouse button) Or navigate to the program file, eg C:\Program Files\CFGSR\ExtIO_Si570

Note the links in the HDSDR Start Menu. Keyboard Shortcuts may be useful. Direct frequency entry, shifting up and down bands in defined steps. Many other features.

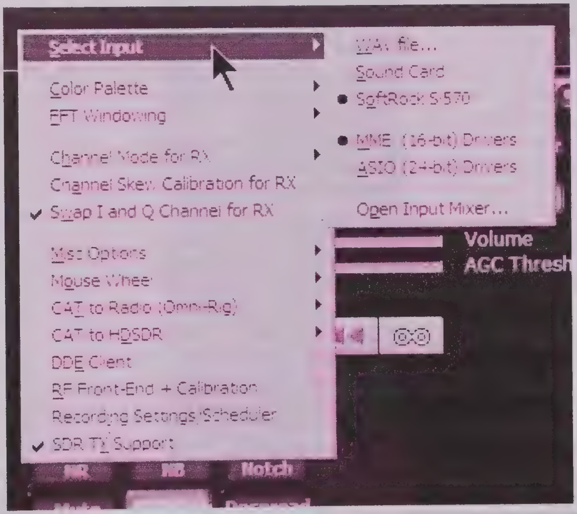
When starting you probably will NOT get this.



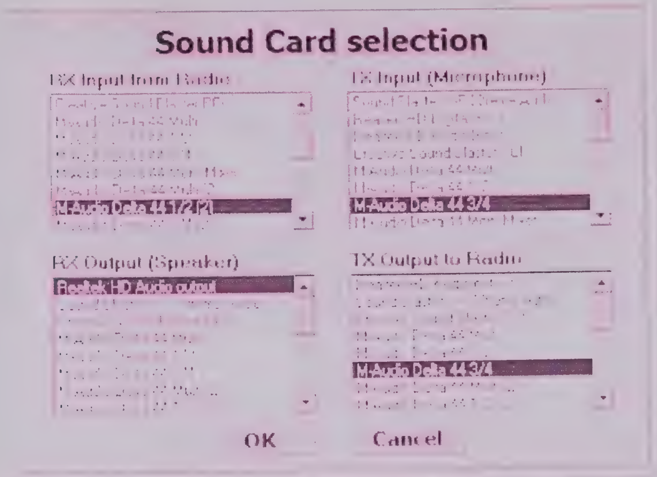
But if you do select the DLL and "Open"

Winrad has a fairly basic interface, when first started it will fill the screen, some versions can be made to start in a window. Current versions of HDSDR open in a window. This window may be resized.

In the set up you must select the Input Source as 'SoftRock V9.0 Si570'.



MME drivers will work with all cards.
If you have ASIO it may be used only for receive.
For use with transmit a second soundcard (or VAC) is required MME drivers only. Some raise concerns about this, ASIO drivers are better but perhaps the actual advantage is small.



Sound Card selection

RX Input from Radio: M-Audio Delta 44 1/2 (2)

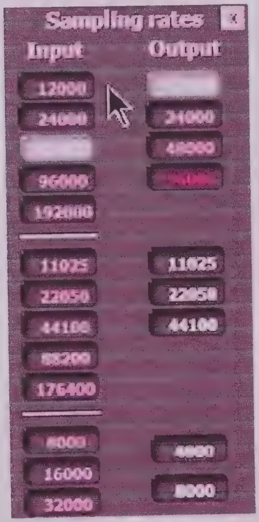
TX Input (Microphone): M-Audio Delta 44 3/4

RX Output (Speaker): Realtek HD Audio output

TX Output to Radio: M-Audio Delta 44 3/4

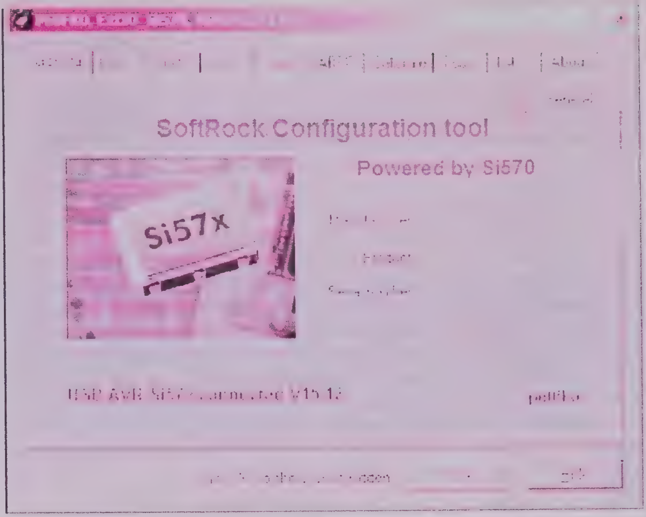
You probably will not have so many sound systems, here I have selected 3 different ones. For transmit two are required, one may be VAC for data modes.

You may need to set your soundcard mixer to set the correct input, keep the RX input as low as possible so the HDSDR noise level rises only slightly. Disable all special effects.

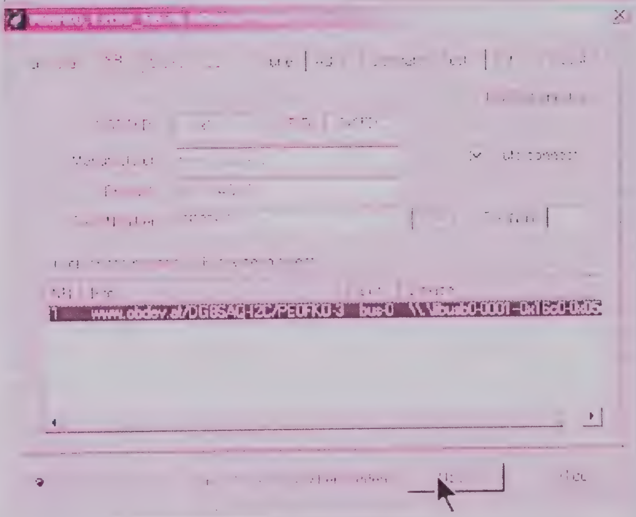


Only select a sample rate your card is able to use. 48000 is a good start, all will be able to use this.

Press keyboard "H" or click "ExtIO



The green dot should be present, bottom left. and the connected information Note the Manufacturer and other fields do not always show any entries.



1 www.obdev.at/DG8SAQ-I2C/PE0FKO-3 bus-0 \\.\libusb0-0001--0x16c0-0x05

If the USB is not connected got to the USB tab, check it is present, select it and "Open"
If there is nothing here you will have to diagnose the problem.
https://sites.google.com/site/g4zfqradio/attiny_usb

Make sure that the Options - Swap I and Q Channel for RX is set correctly. It normally needs to be ticked but ensure that SSB signals are on the correct sideband and that tuning is correct, that higher frequencies ARE actually to the right.
Note if you have not set "Options - Channel Skew Calibration" (Image rejection) you will see images on strong signals. Do not be confused.

architecture CPU/memory (32 bit or 64 bit).

The following links are provided and, as of 1/22/2012, are current. Links highlighted in an Aqua-colored background apply only to those Softrock kits that use the SI570 programmable oscillator:

Software	Role/Purpose	Function	Download Link	Notes
[illegible]	Configure/Control Ensemble microcontroller	Configure	[illegible]	(latest version is 2.6 - now installs EXTIO_Si570 in the CFGSR Folder)
[illegible]	[illegible]	[illegible]		[illegible]
[illegible]	New installer for "signed" PE0FKO-USB-Driver from Fred, PE0FKO.	Driver	[illegible]	The installer is made together with Tom Baier (DG8SAQ) that is also using it for the VNWA. The installer will first install the certificate that makes it a "signed" driver, and then install the driver itself (Windows XP thru Windows 8, 32 & 64 bits). After installation, the Ensemble USB cable can be plugged into the PC. Installed driver is V1.2.6.0
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

				[illegible] Preferred installation method is the [illegible] method [illegible]
SDR #	SDR # ("SDR Sharp") for RX	RX	Download	Very good and simple program (RX only; TX tbd) from Youssef Touil. Alan, G4ZFQ, has a nice article on setting up SDR# for an Ensemble RX II.
Rocky (V3.7)	Simple SDR (RX/TX) Program (see note below)	RXTX	download	SSB RX, CW and PSK-31 RXTX. Great little Windows-based program (but it has its issues with more modern versions of Windows - soundcards).
HDSDR (V2.51)	Elegant SDR (RXTX) Program (based upon original Winrad)	RXTX	download	CW is very basic and only properly useable on the older 6.3 Softrocks. For installation and setup info, see: these pages from Alan, G4FZQ.
(32/64 bit Windows 7, Vista, XP) PowerSDR-V2.4 For Homemade	Latest Version of FlexRadio's PowerSDR tailored for I/Q Soundcard-based SDRs	RXTX	download	Has Si570 Control Capability (Please see Christos' message 2583

SDR Transceivers				on the PowerSDR-IQ Yahoo Reflector). This is good for all Windows platforms and handles RX and TX in all modes. All required software is furnished (although must download the basic FLex PowerSDR V2.4 from the Flex site). This is the most comprehensive of all the packages. However, commensurate with its power comes a steep learning curve.
(Windows XP) PowerSDR-IQ V1.12.20	Version of FlexRadio's PowerSDR tailored for I/Q Soundcard-based SDRs	RXTX	download	Has Si570 Control Capability. Based upon recent experience, the PowerSdr v2.4 above is recommended in lieu of this version.
(Windows 7, Vista) PowerSDR-IQ V1.19.3.15	Version of FlexRadio's PowerSDR tailored for I/Q Soundcard-based SDRs	RXTX	download	Based upon recent experience, the PowerSdr v2.4 above is recommended in lieu of this version. Has Si570 Control

				Capability (Please see Christos' message 43204 on the Yahoo Reflector)

*Note on installing PE0-FKO's USB Drivers: Fred's website has an excellent step-by-step guide to instaling the USB driver. However, see the All-In-One installer (it renders the instructions unnecessary)

Install Driver

⚠ To be extra safe, it is highly recommended that you install the drivers with no other USB devices connected directly to your PC during the install. If your mouse and/or keyboard are USB, reconnect them through a USB hub. This seems to help avoid the dreaded "Unknown Device" Problem.

The correct procedure is to download the driver and put it in a suitable folder, then plug in the USB lead, Windows should detect new hardware has been found and you need to manually point it to the folder containing the drive. It should then install correctly. Certainly does on Win2000 and XP. On Vista or Windows 7, there used to be some issues with driver signing. There have been messages on the forum describing methods of working around these issues. One such solution is addressed in the author's MOBO4.3 builders notes.

LibUSB - "Unknown Device" Error

Others have experienced the dreaded "Unknown Device" problem upon plugging in the USB cable after having installed the LibUsb driver. This "unknown device" problem (and a remedy for those who are using Logitech cordless mouse and/or various wireless internet connection adaptors) are discussed in message #45071 and Message #47755 on the Yahoo Softrock40 Group

Another valueable resource for troubleshooting the "unknown device" error is Alan's webpage Installing the ATTiny45/85_USB Controller

Install/Run CFGSR ("ConFiGureSoftRock")

Once the driver is installed, if you run 'CFGSR' that will either automatically 'open' the firmware, or if not, you need to go to the 'USB' tab and select it from the list displayed in the bottom box. Which way depends on if you have 'CFGSR' set up to auto connect on program start or not.

⚠ Following configuration with CFGSR, it is adviseable to use one of

BUILD

The following links are provided and, as of 7/8/2010, are current:

Software	Role/Purpose	Download Link	Notes
CFGSR	Configure/Control Ensemble microcontroller	download	(latest version is 2.3)
SRDLL	dll for Softrock controllers (resides in same folder as CFGSR)		(now part of CFGSR install file)
USB driver(s)	drivers for ATTiny85 USB	download	Zip file with 32 and 64 bit drivers (latest version is 1.2.0.1)*.
HDSDR	Simple SDR (RX only) Program (based upon original Winrad)	download	
Rocky	Simple SDR (RX/TX) Program (see note below)	download	
(Windows XP) PowerSDR-IQ V1.12.20	Version of FlexRadio's PowerSDR tailored for I/Q Soundcard-based SDRs	download	Has Si570 Control Capability
(Windows 7, Vista) PowerSDR-IQ V1.19.3.15	Version of FlexRadio's PowerSDR tailored for I/Q Soundcard-based SDRs	download	Has Si570 Control Capability (Please see Christos' message 43204 on the Yahoo Reflector)

Note: Rocky latest version is 3.6. Operates fine on Windows XP; in later Windows versions, Rocky will operate, but only recognizes USB soundcards. Has RXTX for CW and PSK31; RX only for SSB.

*Note on installing PE0-FKO's USB Drivers: Fred's website has an excellent step-by-step guide to instaling the USB driver.

Install Driver

The correct procedure is to download the driver and put it in a suitable folder, then plug in the USB lead, Windows should detect new hardware has been found and you need to manually point it to the folder containing the drive. It should then install correctly. Certainly does on Win2000 and XP. On Vista or Windows 7, there used to be some issues with driver signing. There have been messages on the forum describing methods of working around these issues. One such solution is addressed in the author's MOBO4.3 builders notes.

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Once the driver is installed, if you run 'CFGSR' that will either automatically 'open' the firmware, or if not, you need to go to the 'USB' tab and select it from the list displayed in the bottom box.

Which way depends on if you have 'CFGSR' set up to auto connect on program start or not.

For further discussions of the software side of SDR and soundcard issues, see Alan G4ZFQ's pages.

lots of info

Test Local Oscillator

You can use 'CFGSR' to exercise the Si570 using the 'Tune' tab that makes it into a 'VFO'. Just a case of setting the frequency, and the Si570 should output a signal at 4 times the frequency displayed on the main display on the screen. The 'Test' tab can also be used to look at all the various Si570 registers etc, but probably unnecessary as if you can hear or measure the Si570 output frequency, you know it is working.

ok

Configure Si570 for LF Option

For the LF version, it will be essential to change the firmware configuration to successfully operate that version. Tthe default values are only suitable for the 'normal' HF version.

Changes needed are (using CFGSR.exe):

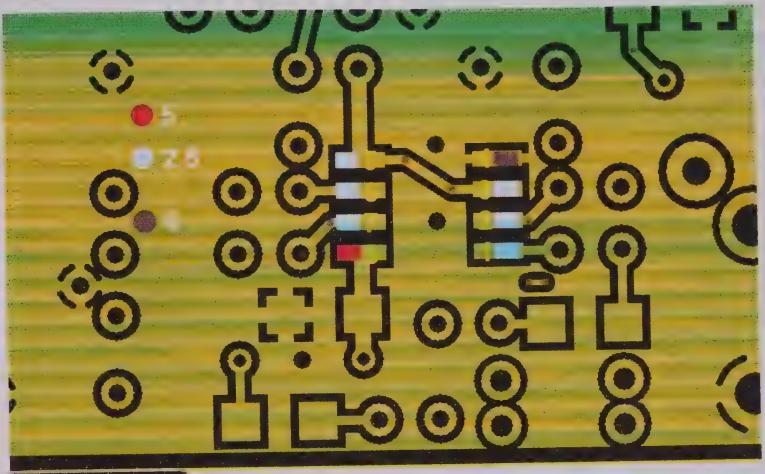
- **Si570 tab**
  set the minimum device frequency to 3MHz (default 6MHz). Although the Si570 will not run below 3.5MHz, the box only accepts integer values
- **LO tab**
  need to change the 'LO:Total' multiply for bands 0 - 3 from the default x4 to x16
- **ABPF tab**
  need to change the filter cross over points to 0.4, 0.8 and 1.6MHz

(TX to Bob G8VOI for the instructions on how to configure the Ensemble RX II Local Oscilklator for LF operation.)

Local Oscillator and Control Completed Stage

(These photos were of an earlier board design. It has changed since the author built the kit upon which these notes are based. The board layout graphics are, however, current.)

Top of the Board



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Test Steps (if any)

Step	Test Point	UOM	Nominal	Author's	Builder's
1	Pin 1 (50% of 5V rail)	V dc	2.5	2.45	
2	Pin 2 (50% of 5V rail)	V dc	2.5	2.43	
3	Pin 3 (50% of 5V rail)	V dc	2.5	2.43	
4	Pin 4 (gnd)	V dc	0	0	
5	Pin 5 (50% of 5V rail)	V dc	2.5	2.43	
6	Pin 6 (50% of 5V rail)	V dc	2.5	2.43	
7	Pin 7 (50% of 5V rail)	V dc	2.5	2.46	
8	Pin 8 (5V rail)	V dc	5	4.92	

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Operational Amplifiers - Functional Test

Test [illegible]

For this test, you will need to obtain a 10k resistor from your junk box or other source for this test. It is not furnished with the kit

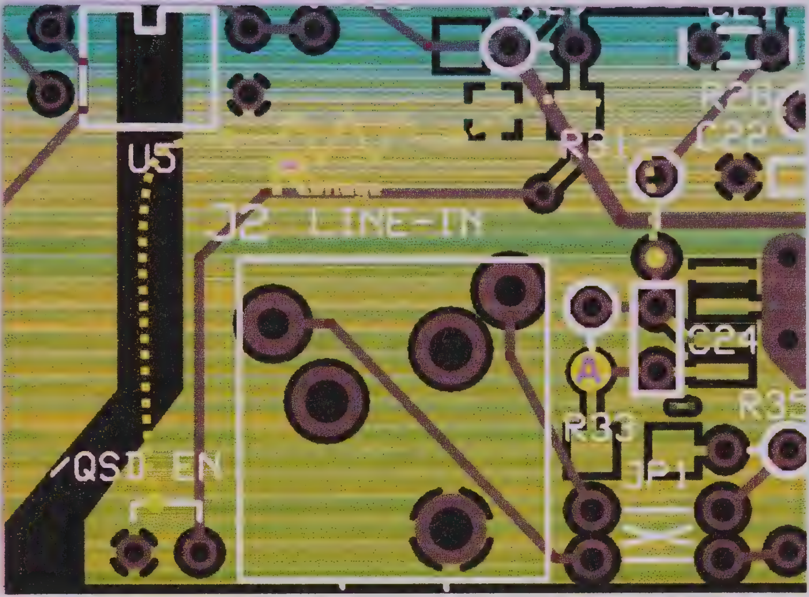
In this test, you will test the DC gain of each of the op-amps by temporarily connecting a bridging resistor (10k) from each op amp inverting input to circuit regular ground. Introducing the "bridging" resistor R_b will result in a test current equal to 2.5 / R_t, which will be balanced by the current fed back from each op-amp's output through each feedback resistor, R_f (i.e., R33 or R32). Each op-amp output will increase in voltage by 2.5 * R_f/ R_b from the nominal DC level of 2.5 volts.

Test the First OpAmp

[illegible]

[illegible]

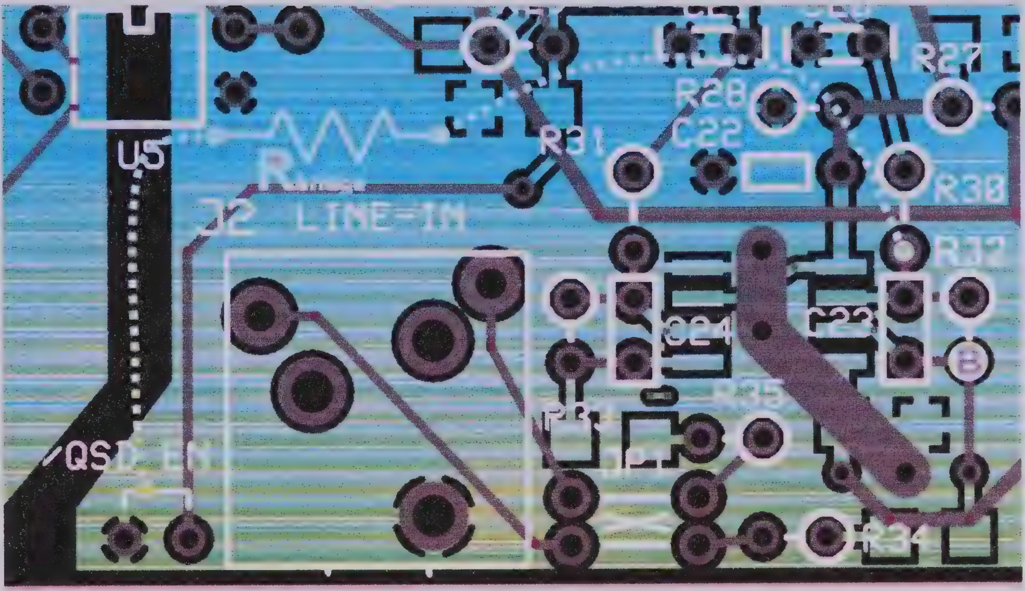
[illegible]



1. Power up the circuit and measure the voltage at pin 1 of the op-amp (hairpin of R33). It should be ~2.5 Vdc
2. Power off and use clip leads to connect R_h between the hairpin of R31 and circuit ground. This provides an input resistance(R_i) of 10 kΩ, to the op-amp.
3. Power up and measure the output voltage (WRT regular ground) at the hairpin of the feedback resistor R33. You should get ~3.75 Vdc at R33 hairpin.
4. Remove R_b and the output voltage at R33 should go back to ~2.5 Vdc.

Remove R_b V at R_{33} should go back to ~2.5Vdc

Test the Second OpAmp



1. Power up the circuit and measure the voltage at pin 1 of the op-amp (hairpin of R32). It should be ~2.5 Vdc
2. Power off and use clip leads to connect R_b between the hairpin of R30 and circuit ground. This provides an input resistance(R_i) 10 kΩ, to the op-amp.
3. Power up and measure the output voltage (WRT regular ground) at the hairpin of the feedback resistor R32. You should get: ~3.75 Vdc at R32 hairpin.
4. Remove R_b and the output voltage at R32 should go back to ~2.5 Vdc.

The diagram above show the test points. The yellow dots show the R_b connection points for each "side" of the opamps. The dots marked "A" and "B" show the measurement points for the output voltages for Each "side" of the OpAmps.

An Excel spreadsheet with a calculator for this test is available for you to plug in your bridging resistor ohms (R_t) and your pin 1 or pin 7 normal voltages (E_{bias}) and predict the expected voltage when bridged (E_{out}).

If your results are not as nominally expected, double check the values of R32 and R33 (both 4.99k, NOT 49.9). See this message thread on the Yahoo Softrock40 reflector.

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Test Steps (if any)

Step	Test Point	UOM	Nominal	Author's	Builder's
1	"A" (hairpin lead of R33 (NOT bridged)	V dc	2.5	2.45	
2	"A" (hairpin lead of R33 (bridged)	V dc	3.75	3.66	
3	"B" (hairpin lead of R32 (NOT bridged)	V dc	2.5	2.46	
4	"B" (hairpin lead of R32 (bridged)	V dc	3.75	3.68	

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Operational Amplifiers - RX Test

Prepare an SDR program for RX (author recommends Rocky for the Windows XP crowd; WinradHD for other Windows OS). This usually involves downloading and installing the program; selecting the desired soundcard for the (STEREO) input of the I and Q signals from the board; and connecting the board to the soundcard with a stereo cable with 1/8" stereo plugs on either end.

Once the SDR program is ready, connect the USB cable from your PC to the board, connect the 12V power to the board, and connect a 50 ohm antenna to J4.

Connect the "Line-In" jack on the pc board to the "Line-In" input jack on the pc or sound card, using a length of male-to-male stereo audio cable, with 18/" stereo plugs

Start the SDR program and adjust the LO frequency to the desired center frequency. You should see signals in the displayed spectrum. If there is a contest going on at test time, you will be even more impressed with the RX.!

Note: for either SDR program to work with the Ensemble RX, you MUST have installed the driver (libusb) for the Microcontroller's USB functionality. For WinradHD, you will also need to have downloaded and saved in the same directory as WinradHD, the ExtIO_Si570.dll file.

If you are seeing perfect mirror images of the signals either side of the center frequency, you should review the information in the Image Rejection Hints page.

⚠ If you installed the I/Q jumpers as suggested, you will need (in Rocky and/or Winrad) to [illegible] "side" of the [illegible]

Note that there is an optional grounding via for the return side of the antenna connection. You do NOT want to connect this to the SDR ground per the advice in the webpage referenced below:).

Ground Loops and Humps

If you experience a large "hump" at the center frequency or several spurii on the spectrum, you may be the victim of ground loops.

Alan G4ZFQ has an excellent article on the effects of ground loops on the SDR and how to minimize/avoid them. (OK, Alan, so it's "minimise"!)

Another great resource from Alan is his page on "SDR with SoundCard Basic Faults" (which graphically shows what poor grounding can do in a sound-card-based SDR application).

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Test Steps (if any)

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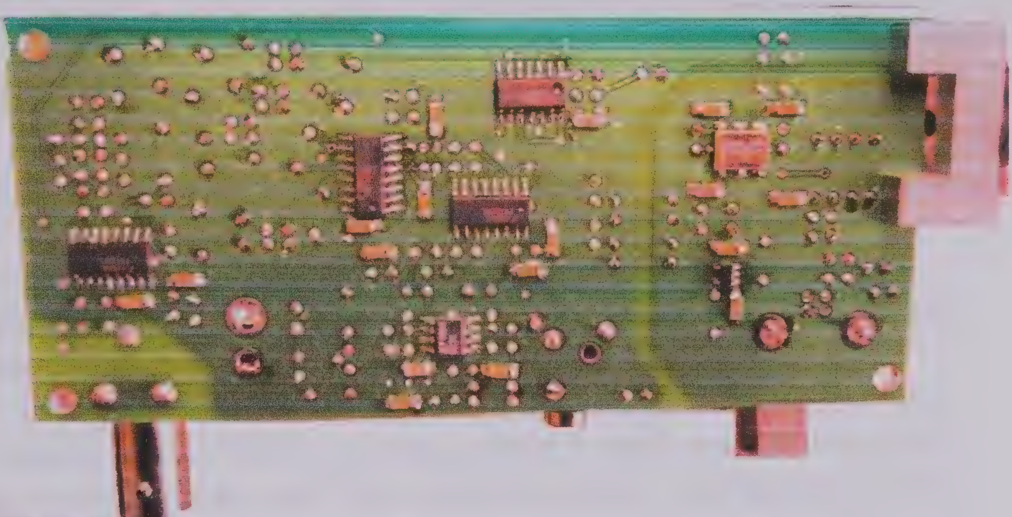

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Test the Operational Amplifiers Stage

Operational Amplifiers - Pin Voltage Tests

wrt regular gnd

[illegible]

As usual, if you are having any problems with this stage, be sure to measure the pin voltages two ways: first, measure each pin at the pin itself (on the IC). Then take a second measurement at the pin pad (on the K)
take a 2nd meas at the pin pad on the bd - should agree -

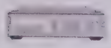
If you are measuring zero volts where expected value is 2.5V, check the voltage at R28 hairpin again (this was checked in the Auto Bandpass Filter stage and should have been ~2.5 Vdc in that check. If it is now zero, check for shorts. Also check for the correct values in R32 and R33. If these were accidentally installed as 49.9 ohms vs 4.99K ohms, the voltage at R28 hairpin could approximate zero .

From: jbbeyer <beyer@engr.wisc.edu>
Subject:
Date: March 9, 2013 10:36:42 AM CST

Jim, well, it seems flaky, but try this sort of thing.
Start up HDSDR. Set LO to 15 MHz. Tune in WWV as best you can using AM.
Press the highlighted ExtIO button. It should give a window that looks exactly like CFGSR. If it says that it can't access the USB, close the window with the X in the right corner, and press ExilO again. If all is well, select the Calibrate tab on the menu. Set "Real" to 15. Set "Tuned" to the frequency you are tuned to, perhaps 14.999954. Press the Calibrate button. Press the Close button, and go back to the HDSDR window. Now tune WWV again; it should be close to the 15MHz mark.

If that has all gone well, tune WWV again. Set to CW mode and look at the filter window in the lower right. With the slider to the left of Zoom expand the display. Hopefully you see a major peak and two side peaks when WWV is not transmitting voice. Put the mouse in the filter display. A green line should appear. Put it on the center frequency peak. The peak should move to 700 on the frequency scale. Now look at your tuned frequency and repeat the calibration step in the CFGSR-like window.

Good luck. I did these things over and over, but believe I am calibrated to a cycle or two.
Don



Auto Band Pass Filters - Voltage Divider Tests

With Power and USB connected, test the output of the three voltage dividers in this stage. Each should yield approximately one-half the voltage on the 5V rail.

Trouble-Shooting the Voltage Dividers

If either of the two voltage dividers does not yield the expected value, check to be certain that the resistors are all 2.2K (red-red-red-gld). You may also want to use the Utility Voltage Divider Calculator to plug in your actually measured voltage and calculate the resistor values that would cause your unexpected result.

Trouble Shooting R15/R16

Assuming you have the correct resistors and you are getting near zero at the junction, look for something

SRDLL.dll
program files
CFGSR

Softrock Lite + USB Xtall V9.0 Local Oscillator Stage

Revision date: 1 Jan 2010

Introduction

Theory of Operation

The local oscillator (U4) is a programmable oscillator, whose programmatic parameters are set by the USB interface, U2.

The user, operating special SDR software on the PC, selects a desired center frequency. The PC issues commands, via a USB port, to U2 (the USB control chip from the preceding stage. These commands will result in U4's producing a frequency that is exactly 4 times the desired center frequency selected in the SDR program.

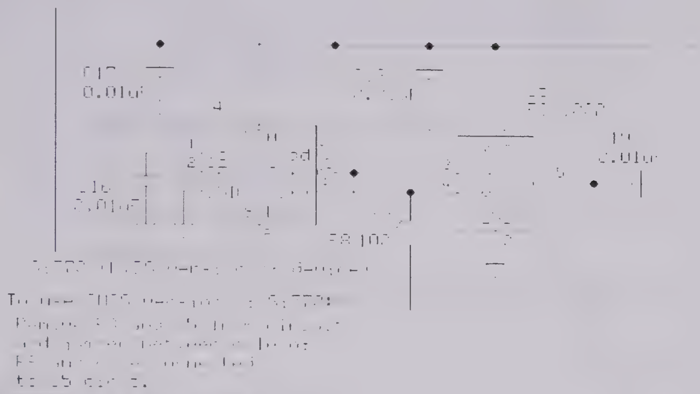
U2 responds to commands from the PC, translating them into commands in the I2C protocol to control the programmable oscillator U4. (If the I2C commands are not received by U4, it would default to an output frequency of 56.320 mHz.)

The IC U5 is needed if the version of U4 is the "LVDS" version. If U4 is a CMOS version, U5 (and R8) are not required and, instead, a jumper wire is installed to bypass them.

This LO stage must produce an output rf signal (available at J1 pin 4) that is four times the desired center frequency for the radio. This is then fed to the dividers/phasors section to produce the two center-frequency signals that are in quadrature and ¼ the LO frequency.

Schematic

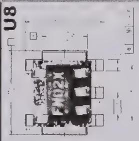
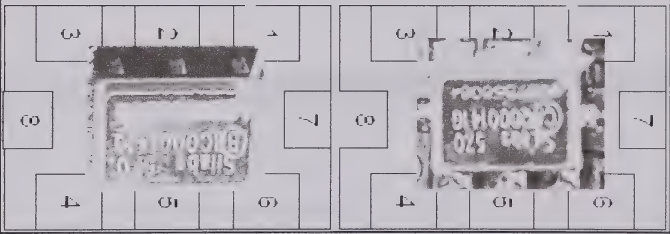
This is a subset of the . Note: red dot indicates resistor testpoints (hairpin, top, or left-hand lead)



Bill of Materials

Note:

Occasionally, Tony is required by logistical issues beyond his concern to ship the Si570 chip in a separate, later shipment. This is due to lead time considerations on his bulk orders from SiLabs, making it impossible to ship the complete kit in one shipment.

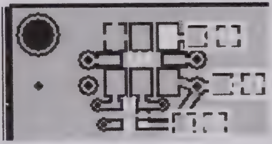
Designation	Value	Color/Code	Orientation	Cate
U5		FN02X		SMT
U4	(CMOS version of device)			SMT
C16	0.01uF			SMT 120
C17	0.01uF			SMT 120
C18	0.01uF			SMT 120
R08	100	||||	flat-h	
J1	9 pin			
C19	0.01uF	103		cera

Summary Build Notes

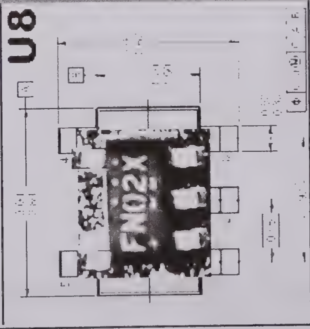
- Install U5 - only for LVDS version of Si570 (bottom)
- Install U4 (bottom)
- Install 3 SMT capacitors (bottom)
- Install resistor (top, if LVDS)
- Install main bus jack, J1
- Install ceramic cap C19
- Install CMOS jumper wire (if Si570 is CMOS versio)
-

Detailed Build Notes

Bottom of the Board



Install U5

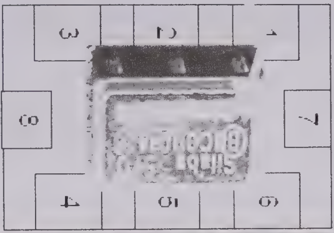
Designation	Value	Color/Code	Orientation	Category	Notes
U5		FN02X		SMT SOT-23	LVD: only: do n insta U4 is CMO versi

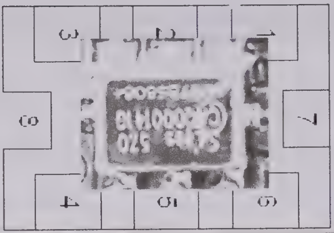
Install U4

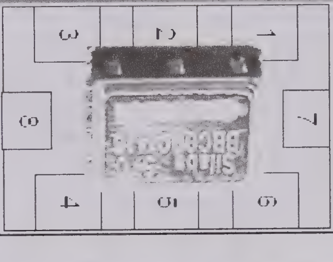
Orientation: Check the [illegible] to [illegible] the proper orientation for

U4 Installation

Note: There are two versions of the Si570, the CMOS and the LVDS. See the chart below for how to distinguish them (the chips are shown in their mounting orientation for this [illegible] [illegible] [illegible]



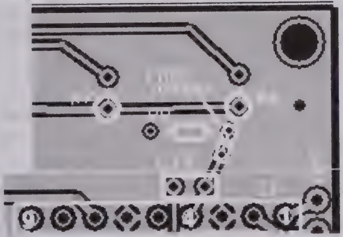


Designation	Value	Color/Code	Orientation	Category	Notes
U4				SMT	(LVD versi show

Install SMT Capacitors

Designation	Value	Color/Code	Orientation	Category	Notes
C16	0.01uF			SMT 1206	
C17	0.01uF			SMT 1206	
C18	0.01uF			SMT 1206	

Top of the Board



Install Resistor (see notes)

Designation	Value	Color/Code	Orientation	Category	Notes
R08	100	▮▮▮	flat-h		omit for CMOS

Install Ceramic Capacitor C19

Designation	Value	Color/Code	Orientation	Category	Notes

C19	0.01uF	103		ceramic	

Install CMOS Jumper (only required of Si570 is CMOS version

Designation	Value	Color/Code	Orientation	Category	Notes
short jumper wire					

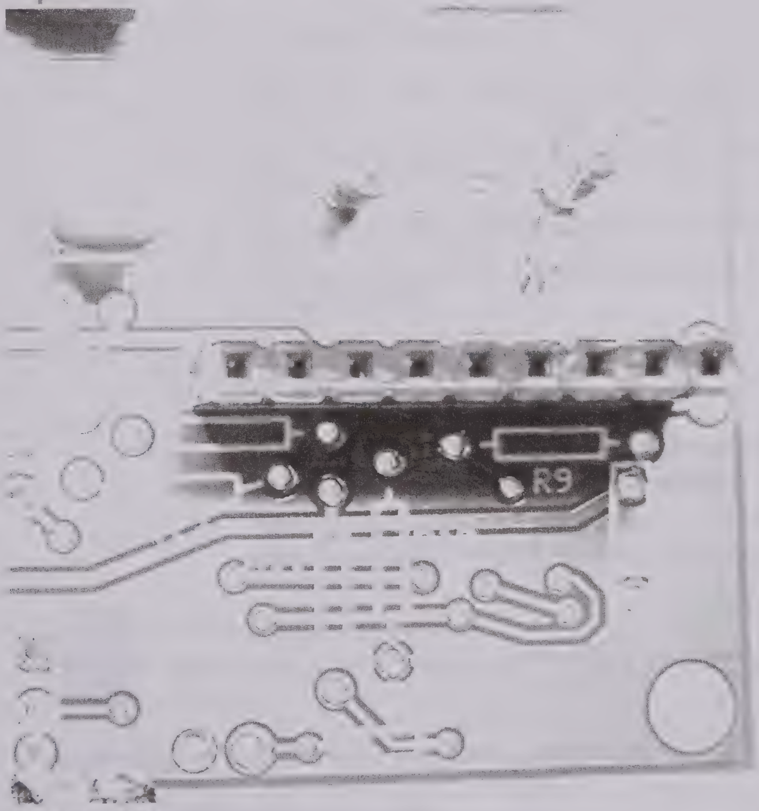
Install Main bus Jack J1

Note: J1 through J3 all mount on top of the circuit board with the [illegible] through the board for soldering the connector in place.

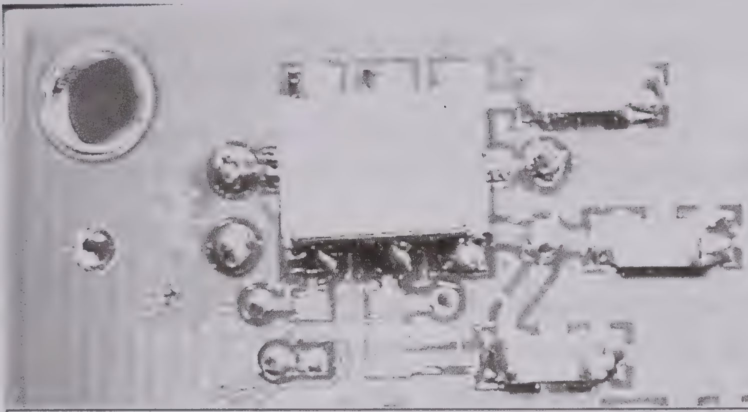
Designation	Value	Color/Code	Orientation	Category	Notes
J1	9 pin				

Completed Stage

Topside



Bottomside



Testing

Current Limited Power Test

- Connect a 1 k ohm resistor in series with the power line and apply 12 V dc power
- the current should be relatively low (around 10 mA or less). Author's results = 8.1 mA
- Measure the voltage WRT ground at the +5 V testpoint at J2.
- A voltage of around 1-2 V dc indicates the power rail is not shorted. Author's results = 997 mV

Current Draw (DMM)

- Current draw here is for the CMOS version of the Si570. Adjust these numbers up by about 14 - 20 mA for the LVDS version.
- With the USB cable unplugged, power up the board, and measure the current draw. This should now go to around 70-80 mA. Author's results 75.4 mA

SI57 Control/Configuration Test

In the preceding stage, you had downloaded and installed Fred PE0FKO's CFGR.exe and SRDDLL.dll files.

Power up your V9.0 board and plug in the USB cable to the PC and the V9.0 board.

Run the CFGR.exe program, again, , and go to the USB tab. In the USB tab, verify that your PC is "seeing" the Microcontroller on the V9.0 board.

Then, go to the "SI570" Tab and make sure the settings are as indicated in the graphic below:

SI570 Tab in CFGR.exe
(This sets the LO to oscillate at 28.2MHZ, a frequency which will yield a center frequency, via the dividers, of 7.05MHz)

Click on the "Reboot" button. This will reboot the firmware. A USB disconnect will happen, and with auto connect, it will connect again and the SI570 should startup at 28.2 MHZ.

Verify LO Output

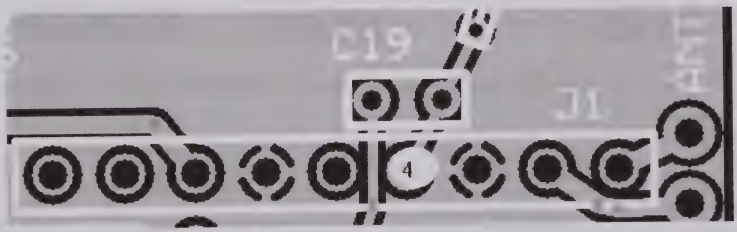
- fashion a small wireloop "antenna" to plug into Pin 4 of J1
- connect a wire to your transceiver's RX ANT jack and loop it through the "antenna" in pin 4 of J1
- Tune the transceiver to receive at 28.200 MHz (4x 7.05 MHz)

Now, try the same exercize but using 14.1MHz (for a center frequency of 3.525MHz). Just go to the "Tune" tab in CFGSR (The 'Tune' tab in CFGSR is in effect a stand alone VFO controller, so whatever frequency you set it to, the Si570 will generate an output at four times that. That is the easiest way to change the LO output frequency.) Then, measure the frequency of the SI570 LO.

LO Output (Scope/Freq Counter)

The Local Oscillator should output a signal at the four times the center frequency selected by Rocky.

Test

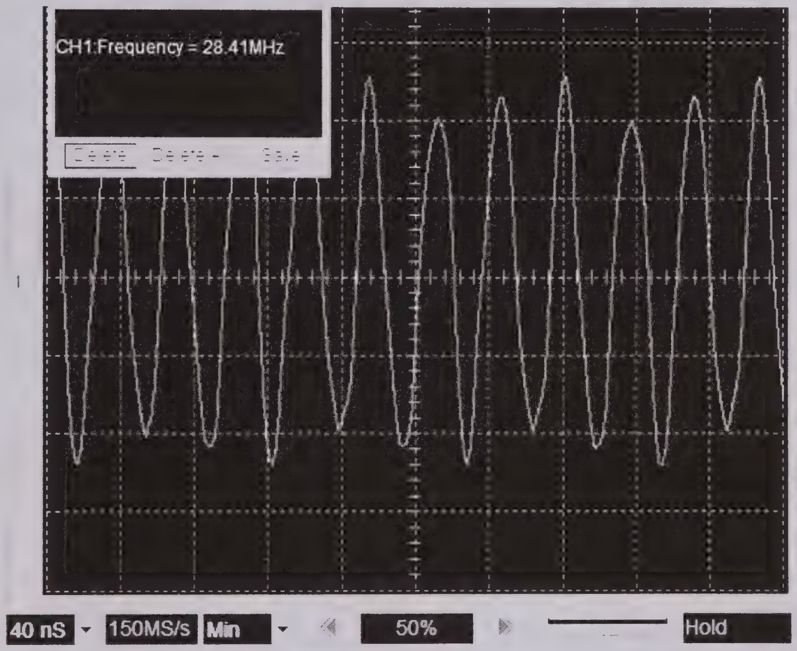


- Tune the USB oscillator settings to get a center frequency of 7.046 MHz
- Apply power to the board
- Test the output of (U8 in the LVDS version of the kit or U4 in the CMOS version) at pin 4 of J1: the frequency should be **28.184** MHz (4 times the desired center frequency of 7.046 MHz).

The AC pk-pk voltage should be aproximately or less than 3.3 V p-p.

The waveform should approximate be a square wave.

- If you get 56.32 MHz (or 14.08 times 4) with tuning set as above, or regardless of the frequency selected, this means:
    - U2 has been incorrectly installed or
    - pins 7 or 8 of U4 may have bad solder joints
    - The USB interface is not working to receive the control signals from the software
    - The software is not configured correctly to use the USB interface



LO Output Test for 40m (frequency measurement is approximate, at best)

tml>

HF BPF 01_Busses and Rails

Search: Search selected SDR sites

Busses and Rails Introduction

General

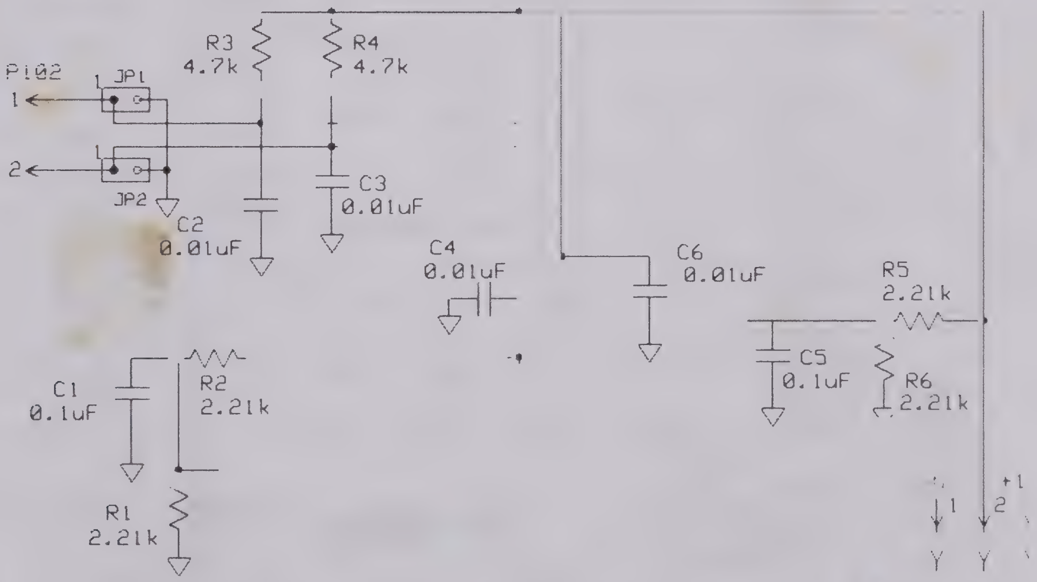
This stage provides the infrastructure "backbone" needed to support the switches and band filter chains.

( )

Busses and Rails Schematic

(Resistor testpoints (hairpin, top, or left-hand lead), as physically installed on the board, are marked in the schematic with red dots)

( )

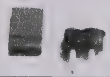


( )

Busses and Rails Bill of Materials

Stage Bill of Materials

(resistor images and color codes courtesy of 's)

Check	Designation	Component	Marking	Category	Orientation	Notes	Circuit
☐	C06	0.01 uF	(smt)	SMT 1206			Busses and Rails
☐	C01	0.1 uF	(smt) black stripe	SMT 1206			Busses and Rails
☐	JP1	header, 2-pin w/jumper		Jumper			Busses and Rails
☐	R01	2.21 k 1/4W 1%	r-r-br-br-br	1/4W	E-W		Busses and Rails
☐	C02	0.01 uF	(smt)	SMT 1206			Busses and Rails
☐	C19	0.01 uF	(smt)	SMT 1206			Busses and Rails
☐	JP2	header, 2-pin w/jumper		Jumper			Busses and Rails
☐	R02	2.21 k 1/4W 1%	r-r-br-br-br	1/4W	W-E		Busses and Rails
☐	C03	0.01 uF	(smt)	SMT 1206			Busses and Rails
☐	P100	header, 9-pin		Header			Busses and Rails
☐	R03	4.7 k 1/4 W 5%	y-v-r-gld	1/4W	W-E		Busses and Rails
☐	C04	0.01 uF	(smt)	SMT 1206			Busses and Rails
☐	P101	header, 3-pin		Header		Pins: 1=gnd; 2=+5 Vdc; 3=+12Vdc. From V9.0 J2	Busses and Rails
☐	R04	4.7 k 1/4 W 5%	y-v-r-gld	1/4W	W-E		Busses and Rails

Install Resistors

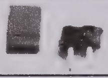
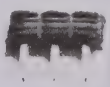
Resistor Orientation Codes

[illegible]

Check	Designation	Component	Marking	Category	Orientation	Notes
☐	R01	2.21 k 1/4W 1%	r-r-br-br-br	1/4W	E-W	
☐	R02	2.21 k 1/4W 1%	r-r-br-br-br	1/4W	W-E	
☐	R03	4.7 k 1/4 W 5%	y-v-r-gld	1/4W	W-E	
☐	R04	4.7 k 1/4 W 5%	y-v-r-gld	1/4W	W-E	
☐	R05	2.21 k 1/4W 1%	r-r-br-br-br	1/4W	W-E	
☐	R06	2.21 k 1/4W 1%	r-r-br-br-br	1/4W	E-W	

Install Connectors

1. JP1 & 2 installed [illegible] with pins pointing upward.
2. [illegible] installed to bottom of board, with pins pointing downward (to [illegible] with the V9.0 board).
3. [illegible] for the V9.0 RX [illegible] to provide the control signals for the BPF switching. JP1 and JP2 will be connected via a cable to the [illegible] on the V9.0 RX board.

Check	Designation	Component	Marking	Category	Orientation	Notes
☐	JP1	header, 2-pin w/jumper		Jumper		
☐	JP2	header, 2-pin w/jumper		Jumper		
☐	P100	header, 9-pin		Header		
☐	P101	header, 3-pin		Header		Pins: 1=gnd; 2=+5 Vdc; 3=+12Vdc. From V9.0 J2

Busses and Rails Completed Stage

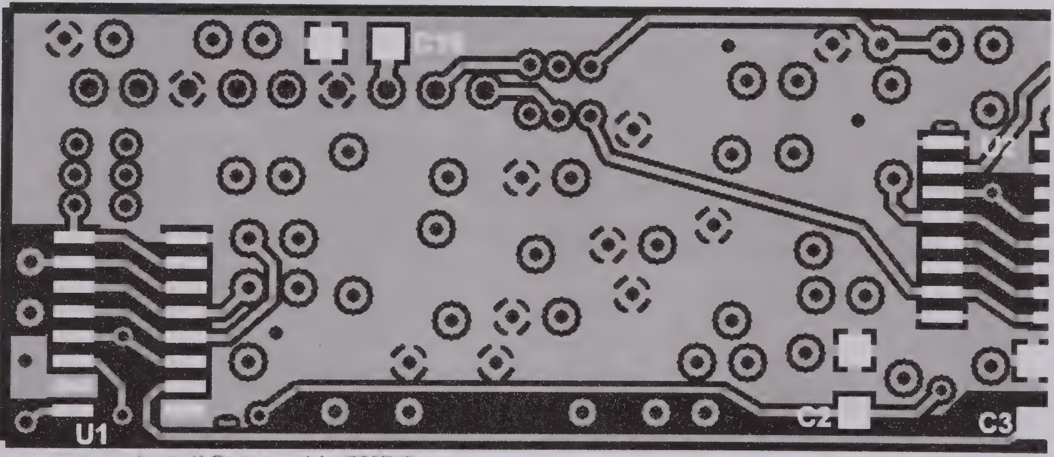
☐	C05	0.1 uF	(smt) black stripe	SMT 1206			Busses and Rails
☐	R05	2.21 k 1/4W 1%	r-r-br-br-br	1/4W	W-E		Busses and Rails
☐	R06	2.21 k 1/4W 1%	r-r-br-br-br	1/4W	E-W		Busses and Rails

Busses and Rails Summary Build Notes

- Install Bottomside SMT Caps
- Install Topside SMT Caps
- Install Resistors
- Install Connectors
-

Busses and Rails Detailed Build Notes

Bottom of the Board

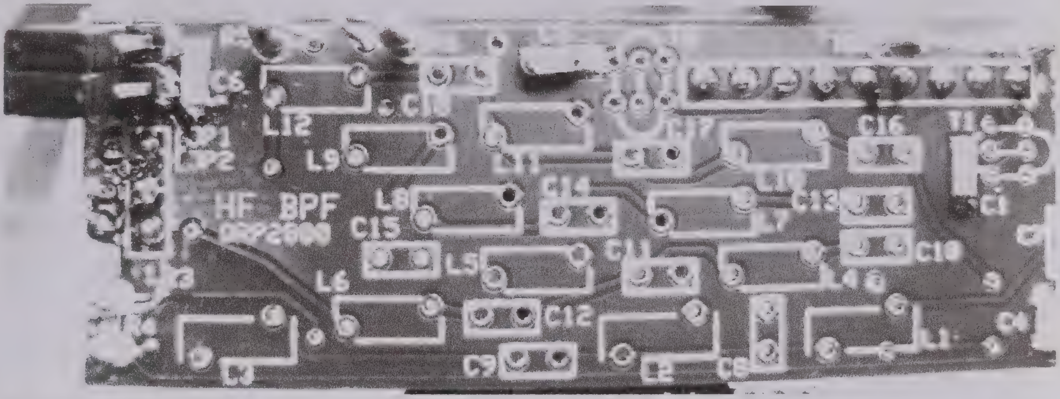


Install Bottomside SMT Caps

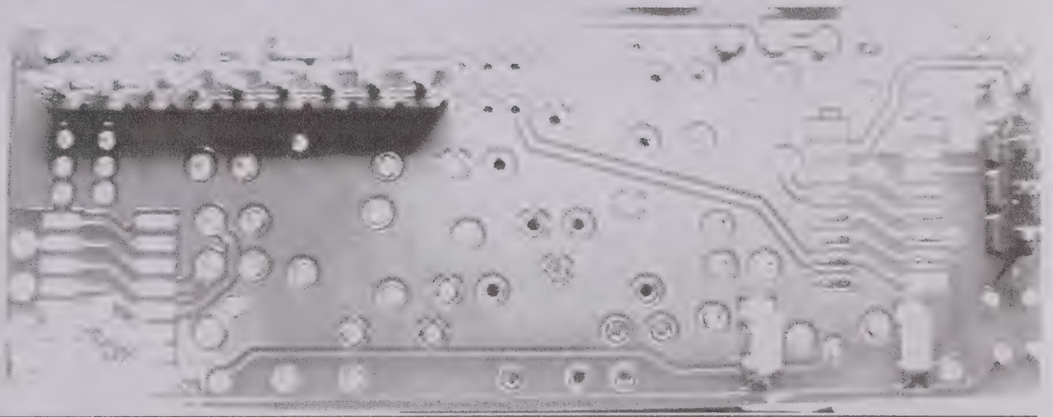
[illegible]

Check	Designation	Component	Marking	Category	Orientation	Notes
☐	C02	0.01 uF	(smt)	SMT 1206		
☐	C19	0.01 uF	(smt)	SMT 1206		

Top of the Board



Bottom of the Board



Busses and Rails Testing

Visual Check

Test Setup

Using very good lighting and magnification, carefully inspect the solder joints to identify bridges, cold joints, or poor contacts.

Resistance Tests

Test Setup

The following tests help validate there is are good solder joints and no shorts on the power rail and should be passed before applying power to the HF-BPF board. If these tests are passed, you can be pretty sure the voltage tests will succeed.

Test Measurements

Testpoint	Units	Nominal Value	Author's	Yours

P101=3pin

P101-pin 2 to P100 pin 3	k ohms	2.21	2.21	
Right-hand pin of JP1 to P100 pin 3	ohms	0	0	0
Right-hand pin of JP2 to P100 pin 3	ohms	0	0	0
R4 hairpin to P101 pin 2	k ohms	4.7	4.72	4.61
R3 hairpin to P101 pin 2	k ohms	4.7	4.63	4.71
JP1 left-hand pin to P101 pin 2	k ohms	4.7	4.63	4.71
JP2 left-hand pin to P101 pin 2	k ohms	4.7	4.72	4.61
C5 right-hand end to P101 pin 2	k ohms	1.7	1.64	1.58
C1 top end to P101 pin 2	k ohms	1.7	1.65	1.38

VoltageTests

Test Setup

This test assumes you have a that has been completed through (at least) the power supply stage. This is required because you want to test the "fit" of P100 and P101 to their corresponding jacks (J1 and J2) on the RX board and the RX board is a convenit=ent source of regulated 5 Vdc power.

- Test the installation of P100 and P101 for "fit" by plugging the HF-BPF board into J1 and J3 of the V9.0 RX board
- Make sure JP1 and JP2 are un-jumpered. This should ensure that R3 abd R4 cause Pins 1 of JP1 and JP2 to be pulled up to the 5 volt rail.
- Apply power (9-12 Vdc) to the V9.0 RX board
- Measure the voltages with respect to ground according to the table below (you can use either of the right-hand pins on JP1 or JP2 as a convenient ground connection)

Test Measurements

Testpoint	Units	Nominal Value	Author's	Yours
P101-Pin2	Vdc	5	4.96	
R6, hairpin lead	Vdc	2.5	2.48	
R1, hairpin lead	Vdc	2.5	2.48	
R3, hairpin lead	Vdc	5	2.96	
R4, hairpin lead	Vdc	5	4.96	

WB5RVZ.Org - Ensemble HF/LF RX II

Register Login

Home Bands Power Supply USB Power LO Dividers
BPFs QSD Op Amps BOM BOM X-Ref Inventory
Revisions WB5RVZ

Ensemble RX II (HF/LF) Home - Band: HF

Announcement - Official Site

This site is now the officially maintained site for the Ensemble RXTX kit. The previous documentation on www.wb5rvz.com is no longer being maintained. If you are curious, you can still pop over to the previous site to see the original documentation, but be advised that it is no longer being maintained there.

Introduction

General Info

FiveDashInc.
— StartHere —

The Ensemble RX LF/HF kit and its 4.5: X 2" board representing the culmination of a long line of Softrock SDR receivers from FiveDash, Inc. (Tony Parks, KB9YIG). The line began with the Softrock 40 RX and went through several iterations of receivers. The most recent receiver was the All-band HF receiver with anautomatically switched bandpass filter. This current kit is a refinement on that kit and further streamlines the kitting process for Tony Parks, the designer and supplier.

This kit is for the HF band. You cah switch between the HF and LF band options via the "Band" tab in the menu at the top of this (and each) page.

HF Option

The Ensemble RX LF/HF kit provides coverage of HF ham bands from 160-10m, in four different optional "super bands" (each with underlap and overlap within the parameters of the associated bandpass filter):

1. Band 0: 160m - Continuous coverage from 1.8 to 4.0 MHz
2. Band 1: 80m and 40m - Continuous coverage from 4.0 to 8.0 MHz
3. Band 2: 30m, 20m, and 17m - Continuous coverage from 8.0 to 16 MHz
4. Band 3: 15m, 12m, and 10m - Continuous coverage from 16 to 30 MHz

The band coverage is via 4 switchable "bands" ("superbands"). Band switching is performed under program control, in conjunction with programmatic control of the receive frequency. This control is provided by an Atmel ATTiny85 micro-controller, acting as a USB device to control the Si570 programmable oscillator and automatically switch to the appropriate band (0-3) as the frequency changes.

As a welcome improvement over other models, this kit provides pcb-right-angle jacks for all external connections: Antenna, USB from the PC, I/Q output to the PC, and Power to the Board. Thus, once built, the kit can be placed in a suitable enclosure and handled thereafter as a "blackbox peripheral" to the PC.

The design of the Ensemble RX is very similar to the receiver design of its sibling Ensemble RXTX. The major difference is the greater band coverage of the Ensemble RX kit (roughly 4 "superbands" on the RX vs. 1 "superband" on the RXTX).

This kit is an excellent value for both the licensed amateur and the SWL who is comfortable with building electronics kits. The skill level and experience requirements are medium-level because of the small size of the components, the requirement to be able to solder SMT parts, and the requirement to wind and install inductors. Thousands of builders have proven this is not an insurmountable set of requirements. If you are new at this, you should try one of Tony's sub $20 monobander RX kits as a "starter/learner" kit.

Several hams have provided interesting/informative galleries of photos as they have followed these build notes:

- Ulf, K1ULF

Recommended Enclosure

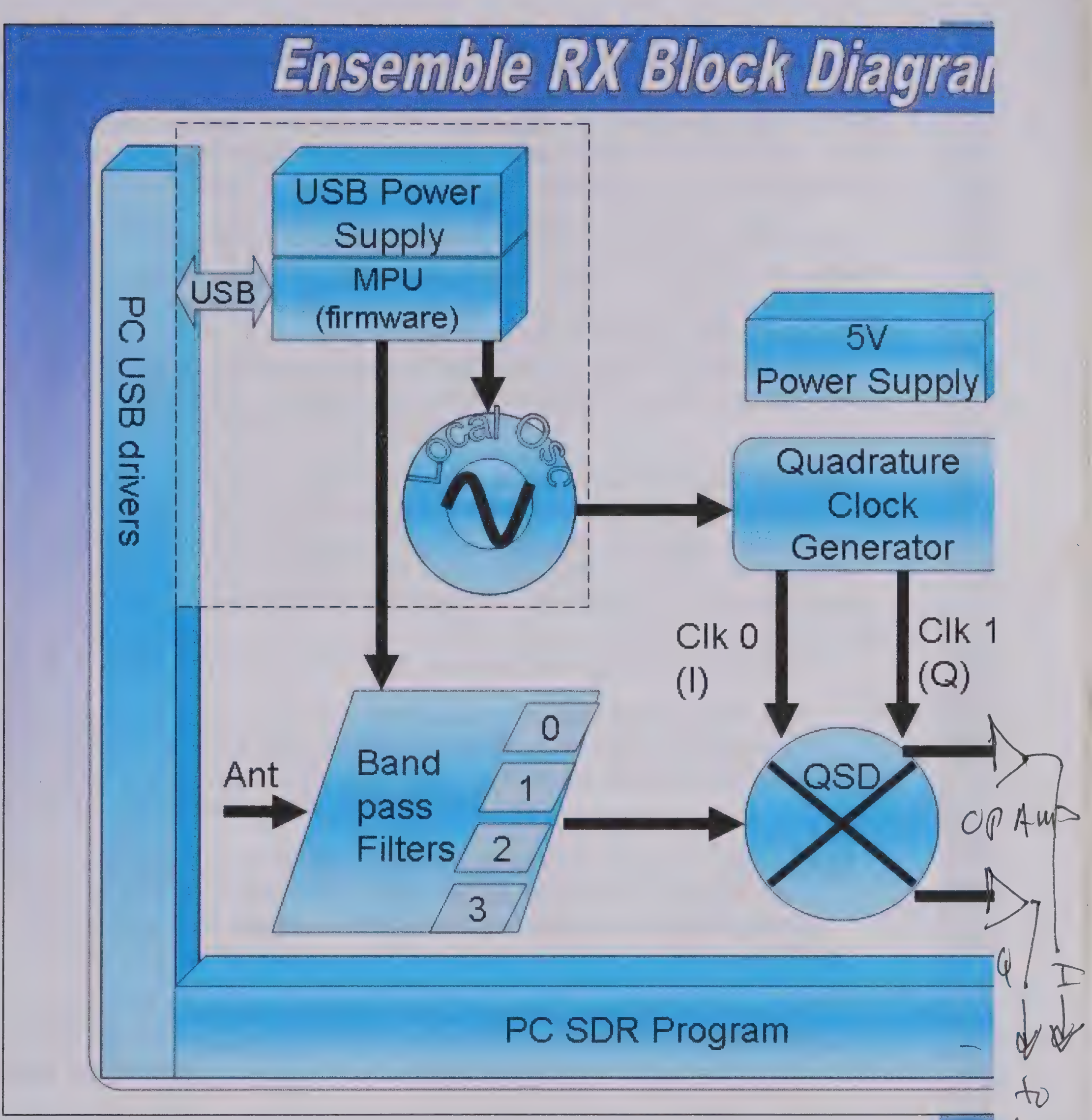
Tom KM5KH offers a very nice enclosure for the Ensemble RX line.

Theory of Operaton

Basic Theory

For a very readable (if somewhat dated) presentation of the fundamentals of SDR receivers, see the presentation by Bob, G8VOI..

Block Diagram



This receiver implements a quadrature sampling detector to produce low frequency I and Q signals for input to the stereo line in inputs of a PC sound card. The I and Q signals are the product of the quadrature sampling detector (QSD) stage, in which bandpass filtered "chunks" of RF are mixed with quadrature clock signals to produce the down-converted I and Q signals. These products (the I and Q pairs) are identical to each other in all respects except phase, where they are 90 degrees apart.

The I/Q products of the QSD ("mixer"), when input to the appropriate SDR

program through the PC's STEREO line-in soundcard input, result in a spectrum display on the PC which will show signals arrayed around a "center frequency". This "center frequency" is the frequency of the I/Q outputs from the Quadrature Clock Generators. The bandwidth of the signals either side of the center frequency will be approximately equal to the sampling rate of the PC's sound card. Thus, if the local oscillator is tuned to produce 28.4 MHz to the Quadrature Clock Generators, they will output two signals (I and Q clocks) at 7.1MHz (the "center frequency"). If the PC's sound card has a 48 kHz sampling rate, then the SDR program can translate the QSD's I/Q outputs into a chunk of spectrum that is 24 kHz either side of the center frequency of 7.1 MHz: i.e, 7.076 - 7.124 MHz. If the LF Option is built (by eliminating the HF Jumper and installing the second 74AC74 IC to allow for a divide-by-16), the center frequency resulting from a local oscillator frequency of 3.5 MHz (the lowest for the Si570) will be approximately 218 kHz.

As the user tunes the receiver, varying the frequency of the local oscillator, the micro-controller tracks the frequency and switches the appropriate bandpass filter into the RF chain. The SDR program's display will update to show the new center frequency and adjust the scale to reflect the current +/- bandwidth around that center frequency. At all times, the operator can see all signals that are within this movable "window" (whose total width is 48, 96, or 192 kHz, depending upon the sampling rate of the PC's soundcard).

The receiver is controlled via a USB connection from the PC. This USB connection provides a "USB 5V" bus for the local oscillator and micro-controller. A separate 3.3 V voltage regulator on the 5 USB 5 volt bus provides power to the programmable oscillator, the Si570.

The RX has an Atmel ATTiny85 micro-controller unit which, acting as a USB device, and on the "USB 5V" rail, controls the frequency output of the programmable local oscillator (Si570) and provides two switching signals which can be used to select one of four filter banks in the band pass filter

The output of the local oscillator is at a frequency which is 4 times the desired center frequency of the receiver and is consumed in the Quadrature Clock Generators.

The Quadrature Clock Generators divides the local oscillator frequency by 4 (or, for the LF option, by 16) to produce two clock signals - QSE Clk 0 and QSE Clk 1 - which will be used to clock the QSD stage. These I and Q clock signals are identical in all respects but phase (they are in quadrature - 90 degrees phase separation).

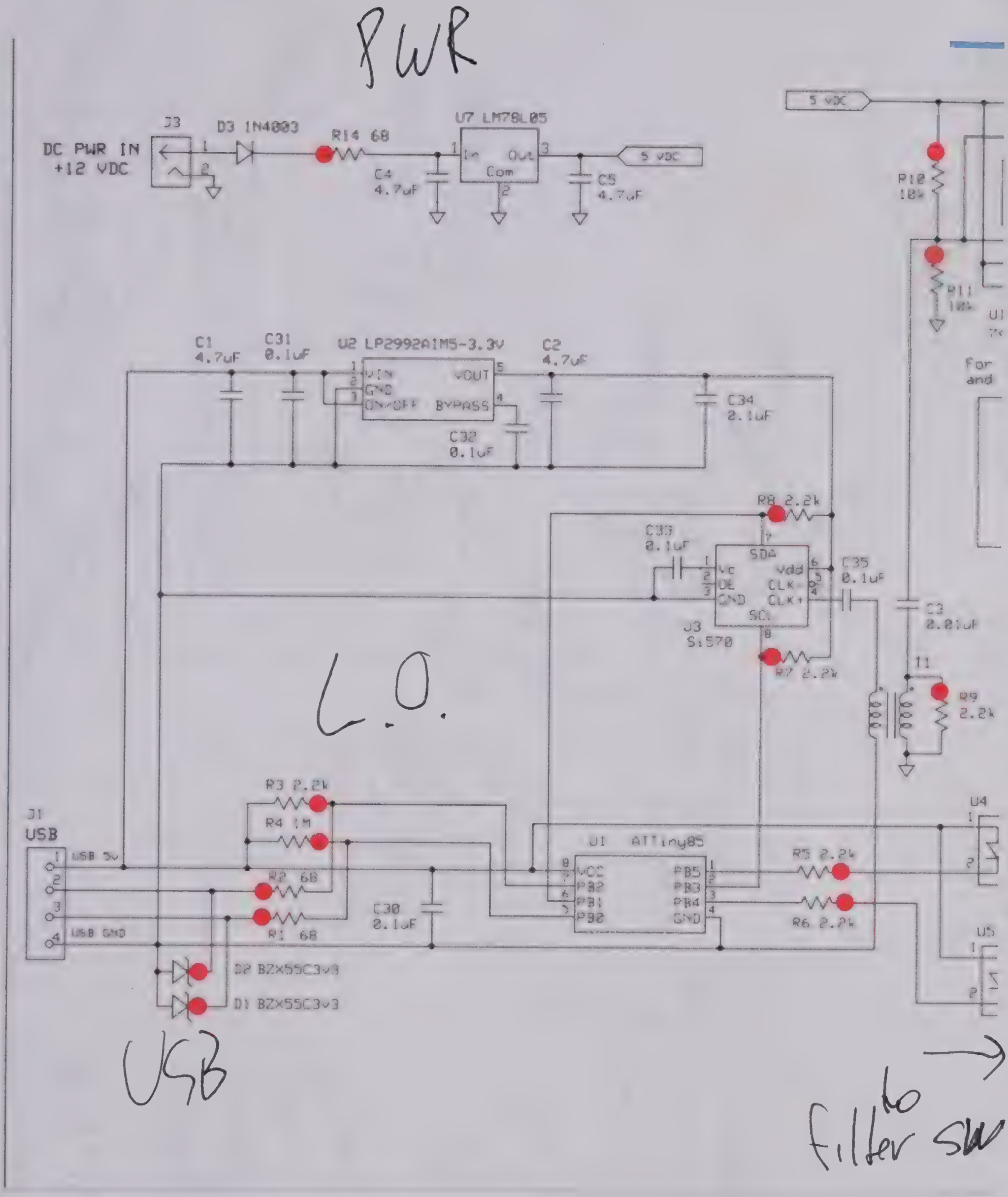
Rf at the antenna jack is filtered through the Bandpass Filter Stage, where one of four "chunks" of the HF (or LF) band is selected by the micro-controller, based upon the tuning of the programmable Local Oscillator. The filtered RF is passed as input to the QSD Stage.

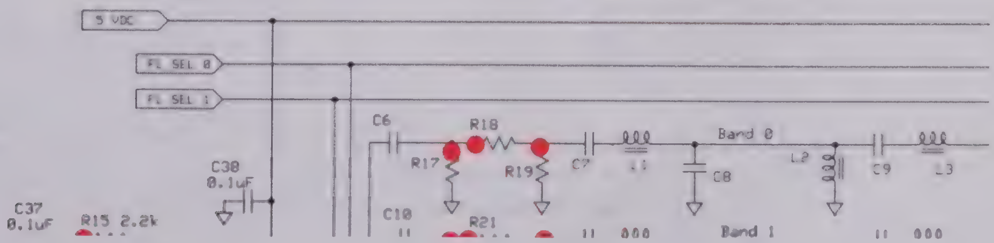
The Quadrature Sampling Detector (QSD) Stage acts very similar to a mixer. It incorporates a high-speed switch that is clocked by the two QSD clock signals from the Quadrature Clock Generators and switches the incoming RF into a RC sampling network. The result is two outputs at low frequency and also in quadrature, which are the down-converted, baseband analogs of the incoming RF signals.

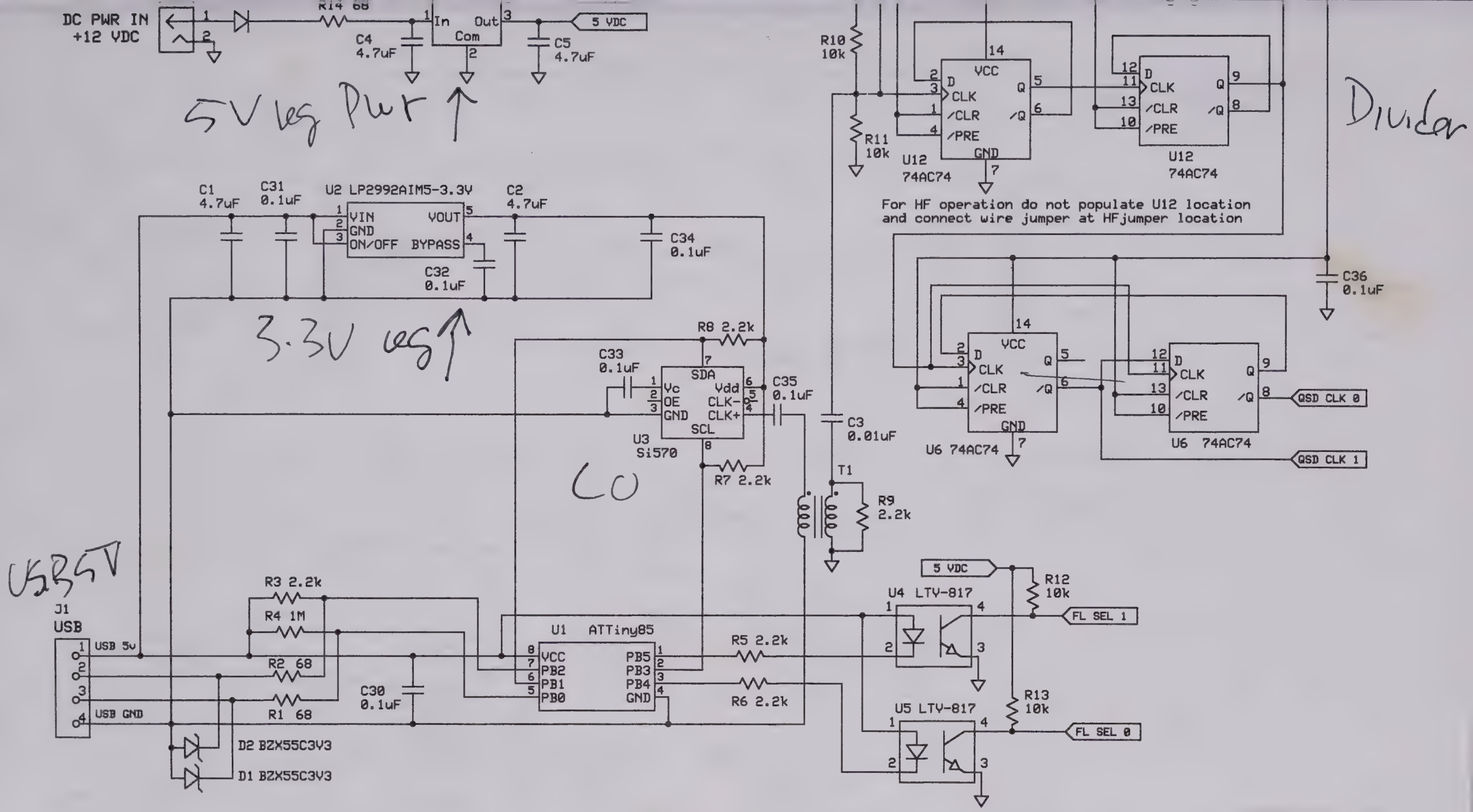
The outputs of the QSD stage are then fed into a pair of high gain Operational Amplifiers to produce the I and Q baseband signals which will be input to the PC soundcard's stereo Line In.

Schematic

Below is the full schematic for the complete kit. In addition, subsets of this schematic will be presented in each build stage, focussing only on the functionality of that stage. Stage-level schematics will have labels indicating "connections" to the subschematics of other stages; you can click on those "connections" to quickly navigate to the indicated stage(s).


PWR
J3
D3 1N4003
R14 68
U7 LM78L05
DC PWR IN
+12 VDC
In
Out
Com
C4
4.7uF
C5
4.7uF
5 VDC
R10
10k
R11
10k
C1
4.7uF
C31
0.1uF
U2 LP2992AIM5-3.3V
VIN
GND
ON/OFF
VOUT
BYPASS
C2
4.7uF
C32
0.1uF
C34
0.1uF
R8 2.2k
C33
0.1uF
SDA
Vc
OE
GND
Vdd
CLK-
CLK+
SCL
U3
Si570
C35
0.1uF
C3
0.01uF
R7 2.2k
T1
R9
2.2k
L.O.
J1
USB
USB 5v
USB GND
R3 2.2k
R4 1M
R2 68
R1 68
C30
0.1uF
U1 ATTiny85
VCC
PB2
PB1
PB0
PB5
PB3
PB4
GND
R5 2.2k
R6 2.2k
U4
U5
D2 BZX55C3v3
D1 BZX55C3v3
USB
to filter sw


5 VDC
FL SEL 0
FL SEL 1
C6
R18
R17
R19
C7
L1
C8
Band 0
L2
C9
L3
C38
0.1uF
C37
0.1uF
R15 2.2k
C10
R21
Band 1



For HF operation do not populate U12 location and connect wire jumper at HFjumper location

SoftRock Projects

RX Ensemble II

Tony KB9YIG

7/01/10

Page 1 of 3

Bill of Materials

The bill of materials for this kit (HF option) is provided in two formats:

- BOM (via the "BOM" tab in the menu at the top of the page): providing summary bill of materials for the components required for this band option (HF option).
- BOM X-Ref(via the "BOM X-Ref" tab above): providing the detailed bill of materials and listing each individual component, along with a cross-reference of the component to the build stage in which it is installed/used.

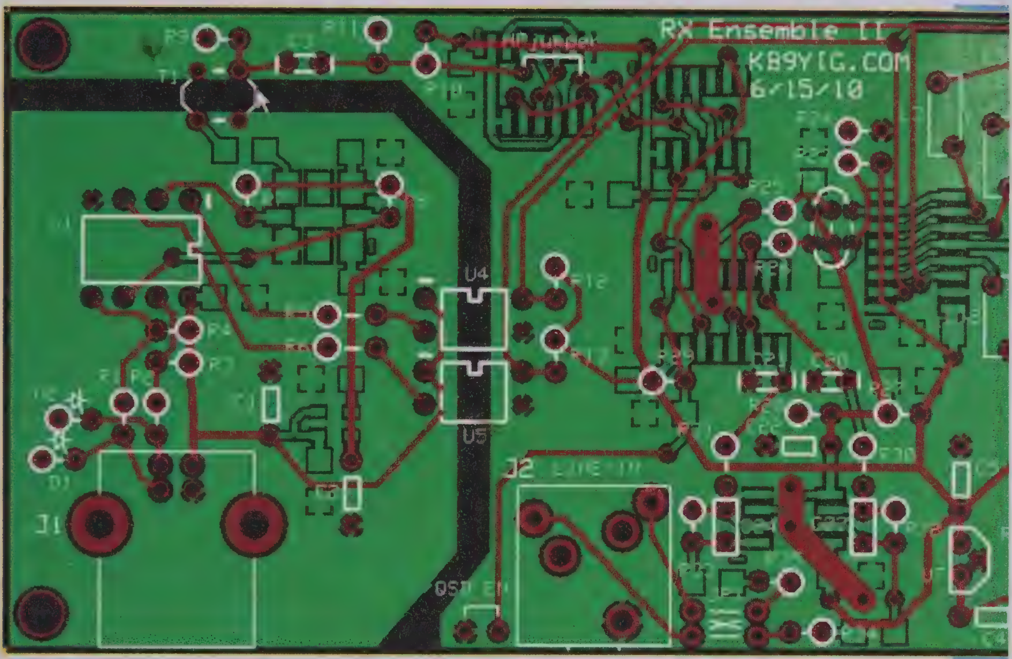
In addition, there is a complete Inventory ("Inventory" Tab, above) of all of the components, irresective of the kit option, provided in the kit (since the kit provides components for both band options, leaving the decision as to which option to build up to the builder at build time). The builder should first verify all components via the inventory; then use the BOM (for the selected option) to select the parts that wil be used in the actual build of the selected option.

Each build stage will also provide a subset of the overall BOM, listing jost those components required in that stage. Similarly, each step in each build stage will present its own "step-BOM" bill of materials, listing only those components needed in that step.

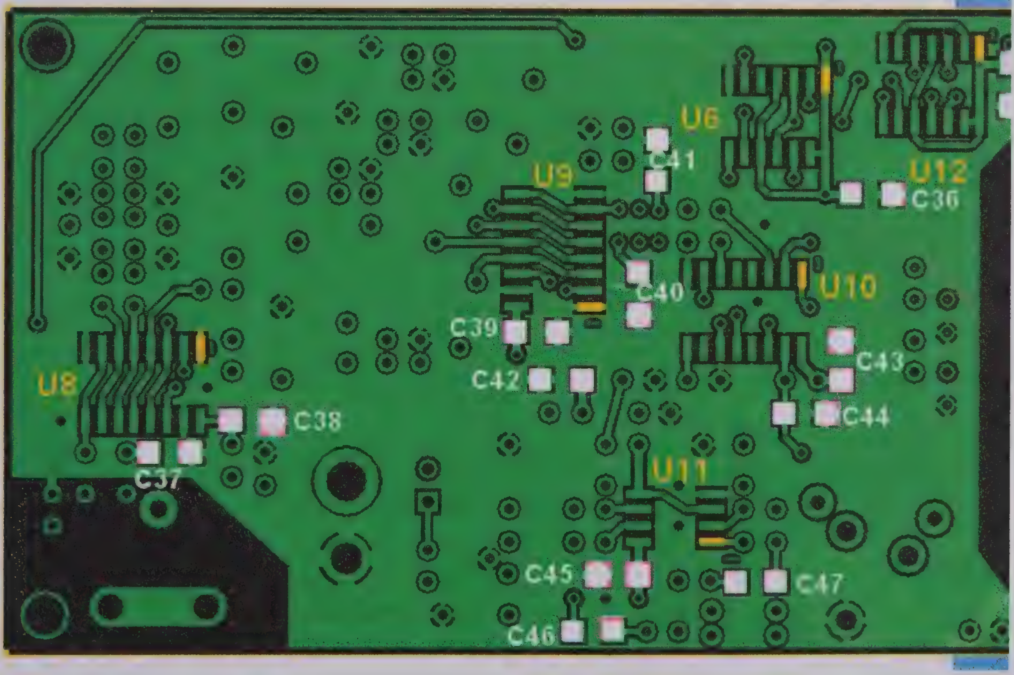
Board Layouts

Below are the full board layouts for the kit. Each build stage will present board layout graphics focussed upon the areas of the board (top and bottom) relevant to that build stage.

Topside


RX Ensemble II
KB9YIG.COM
6/15/10
R9
R11
T1
U4
U5
R12
J2
LINE IN
J1
QSP EN

Underside


U6
C41
U9
U12
C36
U10
C40
C39
C43
C42
U8
C38
C44
C37
U11
C45
C47
C46

Build Stages

This kit is built in stages, with each stage being testable upon completion.

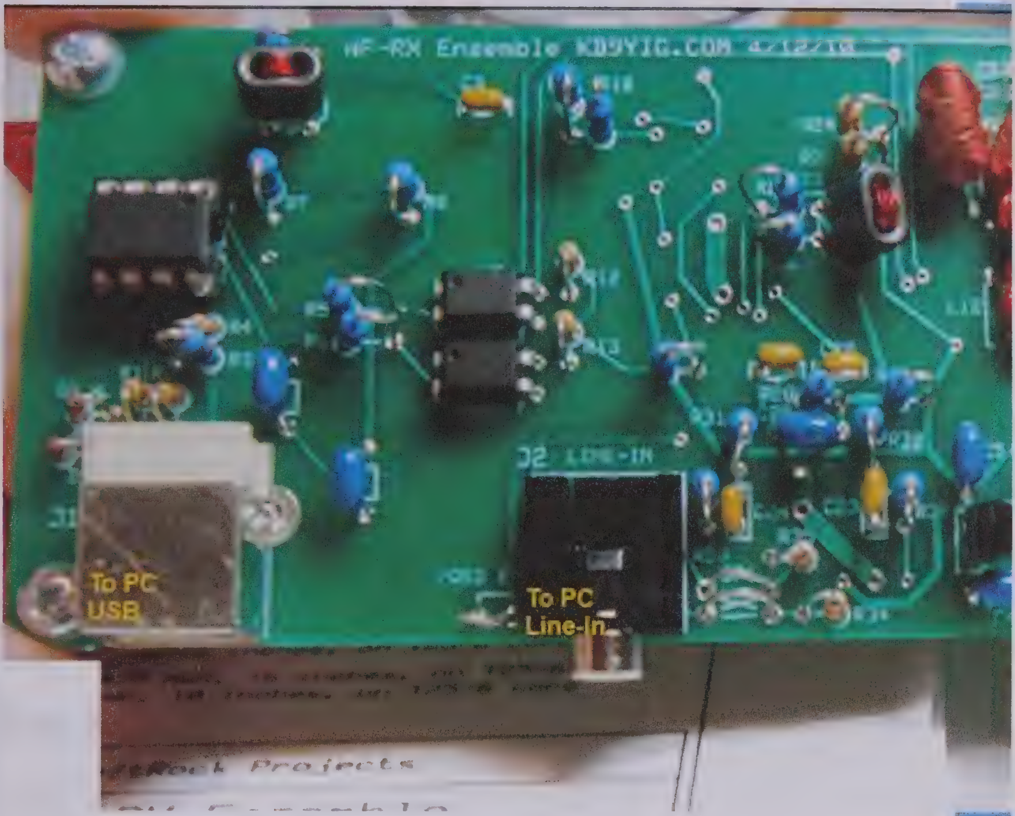
The stages in the build are, in build order:

- Power Supply
- USB Power Supply
- Local Oscillator and Control
- Quadrature Clock Generator
- Auto Band Pass Filters
- Quadrature Sampling Detector
- Operational Amplifiers

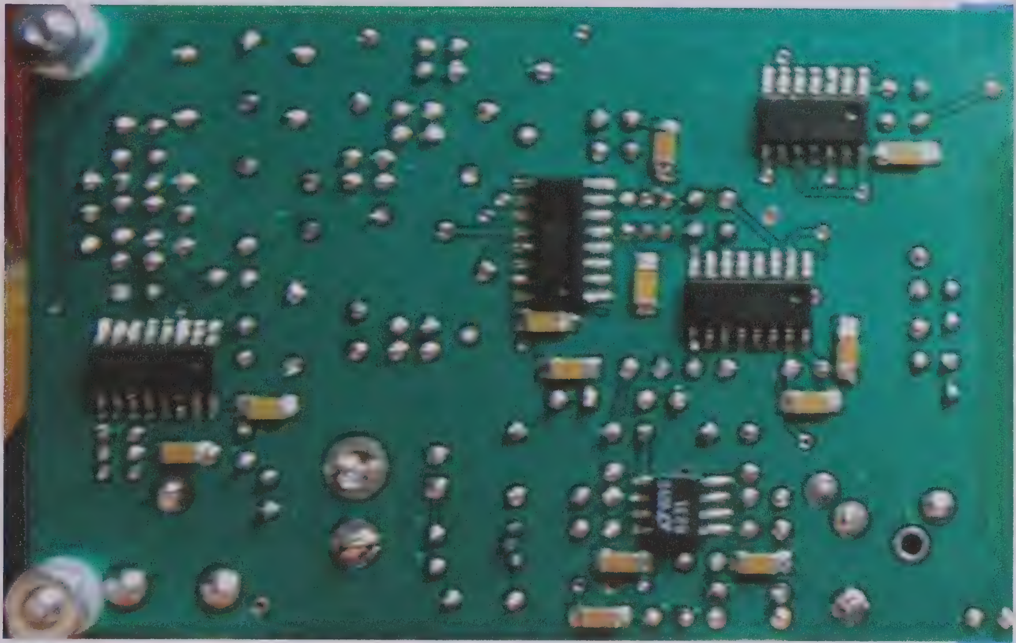
Completed Images

Note: the completed pictures are of the HF option, which the author built. Other band options (which the author did not build) will appear slightly different (especially the inductors, whose windings and cores will vary by band) for the band-specific components.

Topside


WF-RX Ensemble KD9YIC.COM 4/12/10
J2 LINE-IN
To PC
USB
To PC
Line-In

Underside



Background Info

Tools

Winding Inductors

This page has the following inductors:

1. L01

   COIL: 5.5uH: 35T #30(20in) on T30-2(red)
   Using approximately 21 inches of #30 wire, wind 35 turns on a 0.30 inch od T30-2(red) ferrite. Inductance = 5.50 uH.

2. L02

   COIL: 2.6uH: 24T #30(15in) on T30-2(red)
   Using approximately 15 inches of #30 wire, wind 24 turns on a 0.30 inch od T30-2(red) ferrite. Inductance = 2.60 uH.

3. L03

   COIL: 5.5uH: 35T #30(20in) on T30-2(red)

Using approximately 21 inches of #30 wire, wind 35 turns on a 0.30 inch od T30-2(red) ferrite. Inductance = 5.50 uH.

4. L04

   COIL: 2uH: 21T #30(13in) on T30-2(red)
   Using approximately 14 inches of #30 wire, wind 21 turns on a 0.30 inch od T30-2(red) ferrite. Inductance = 2.00 uH.

5. L05

   COIL: 0.46uH: 10T #30(8in) on T30-2(red)
   Using approximately 9 inches of #30 wire, wind 10 turns on a 0.30 inch od T30-2(red) ferrite. Inductance = 0.46 uH.

6. L06

   COIL: 2uH: 21T #30(13in) on T30-2(red)
   Using approximately 14 inches of #30 wire, wind 21 turns on a 0.30 inch od T30-2(red) ferrite. Inductance = 2.00 uH.

7. L07

   COIL: 1uH: 19T #30(9in) on T25-6(yel)
   Using approximately 11 inches of #30 wire, wind 19 turns on a 0.25 inch od T25-6(yellow) ferrite. Inductance = 1.00 uH.

8. L08

   COIL: 0.27uH: 10T #30 on T25-6 c(yellow)
   Using approximately 7 inches of #30 wire, wind 10 turns on a 0.25 inch od T25-6(yellow) ferrite. Inductance = 27.00 uH.

9. L09

   COIL: 1uH: 19T #30(9in) on T25-6(yel)
   Using approximately 11 inches of #30 wire, wind 19 turns on a 0.25 inch od T25-6(yellow) ferrite. Inductance = 1.00 uH.

10. L10

    COIL: 0.46uH: 13T #30 on T25-6 core
    Using approximately 8 inches of #30 wire, wind 13 turns on a 0.25 inch od T25-6(yellow) ferrite. Inductance = 0.46 uH.

11. L11

    COIL: 0.13uH: 7T #30 on T25-6 core
    Using approximately 6 inches of #30 wire, wind 7 turns on a 0.25 inch od

T25-6(yellow) ferrite. Inductance = 0.13 uH.

12. L12

    COIL: 0.46uH: 13T #30 on T25-6 core
    Using approximately 8 inches of #30 wire, wind 13 turns on a 0.25 inch od T25-6(yellow) ferrite. Inductance = 0.46 uH.

13. T01

    XFRMR: 5.76uH: 2T(bi)T #30(8 (2x4)in) on BN43-2402
    Using a total of approximately 7 inches of #30 wire, wind 2 turns , bifilar, on a BN-43-2402 ferrite.Inductance of the single winding (usually the primary) is 5.76 uH.

14. T02

    XFRMR: 23.04uH: 4T(bi)T #30(12 (2x6)in) on BN43-2402
    Using a total of approximately 10 inches of #30 wire, wind 4 turns , bifilar, on a BN-43-2402 ferrite.Inductance of the single winding (usually the primary) is 23.04 uH.

15. T03

    XFRMR: 23.04uH: 4T/2T(bi)T #30(12 (6/2x3)in) on BN43-2402
    Primary: Using approximately 7 inches of #30 wire, wind 4 turns on a BN-43-2402 ferrite.
    Secondary: Using a total of 7 inches of #30 wire, wind 2 turns , bifilar, on the ferrite in the same direction as the primary winding. Inductance of the single winding (usually the primary) is 23.04 uH.

To learn how to wind coils and transformers, please read the

- tips from the experts and then
- view the excellent videos on KC0WOXs Website
- or take a read of Dinesh's VU2FD guidelines.
- You can review the common construction techniques for inductors for details on deciphering the winding specifications, core specifications,and construction of toroidal and binocular inductors.

Component Identification

After soldering problems, the most common cause of trouble in kit building is the installation of the incorrect component. Most often this is the case with resistors (hint - if voltage or current draw tests are way out of whack, suspect resistors or solder bridges). Invest in a cheap multimeter and MEASURE the resistance. As Pete, M0FMT, said: " ... then you don't have to worry about this

modern trend of poor identification of components. I doubt you will find an issue with Tony's kits but measuring is best. A cheap OVA meter costs 2 or 3 bucks and a simple cap bridge is easy to build. (you can search E-Bay for "L/C/F Inductance Capacitance High Precision Meter" and will find several digital L/C meters for $20-$30) These two bits of kit are worth there wieght in gold. Oh and most meters have diode and transistor testers build in... remarkable when you think back to the darkages when I were a lad."

⚠ It cannot be overstressed: do not rely solely on the color codes for identification of the correct resistor; ALWAYS measure with your ohmmeter as a double check. Measure twice, cut once.

Soldering

If you are not experienced at soldering (and even if you are somewhat experienced at soldering), refer to Tom N0SS's excellent tutorial on basic soldering techniques.

The video below describes techniques for soldering SOIC 14 (and 16 and 8) SMDs

"

View the above in full-screen mode on Youtube.

For the more adventurous, there is a process using solder paste and an

WB5RVZ.Org - Ensemble HF/LF RX II

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BOM | BOM X-Ref | Inventory | Revisions | WB5RVZ

Ensemble RX II (HF/LF) Power Supply
Band: HF

Introduction

General Info About the Stage

This stage supplies the "regular" 5 volt power rail, for powering the CMOS chips on the main part of the board.

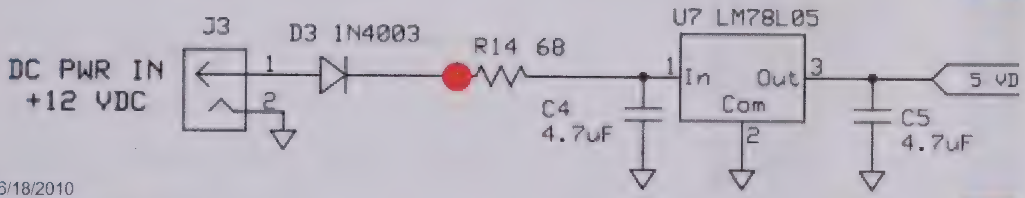
Note: throughout these notes, they will refer to the board in terms of:

- Topside: the side where one can read the silk-screened component designations and outlines
- Bottomside: the reverse of topside, where the SMT components are installed
- Bottom or "bottom edge": the edge of the board where all of the connectors are located
- Top or "top edge": the edge of the board opposite of the bottom edge

Unlkess otherwise noted, all photos/graphics of the board layout are displayed herein with the top edge UP.

Theory of Operation

Stage Schematic



6/18/2010

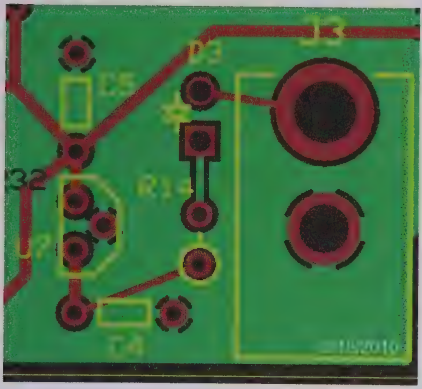
Go to Top of Page

Click here for full schematic

(Red dots represent the "hairpin" (or left-hand or topmost) lead of the component)

Board Layouts

Board Top



Board Bottom

01_ps stage underside

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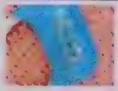
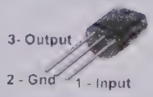
Summary Build Notes

1. Install Power Supply Components
2. Install /RX EN (Ground Point)
3. Test the Stage

Power Supply Bill of Materials (HF band option)

Check	Type	Category	Component	Count	Marking	Image
☐	boardhdw	HDW	4 X #4-40 hdw (nut, bolt, washer, spacer)	1		
☐	Capacitor	Ceramic	4.7 uF 10% 16V X7R RAD	2	475	
☐	Connector	Jack-RA	DC Power Jack PCB Mount (rt-angle) 2.5mm	1		
☐	Connector	Plug	DC Power Plug 5.5/2.5mm Pos Ctr	1		
☐	Diode	Axial	1N4003	1	1N4003	
☐	IC	TO-92	LM78L05 voltage regulator	1	LM78L05 ESD!!!	
☐	PCB	Main Board	Ensemble RX PCB (board)	1		

☐	Resistor	1/6W	68 1/6W 5%	1	bl-gry-blk-gld	
☐	wire	Cutoff	shunt wire (cut-off lead)	1		

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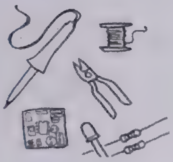
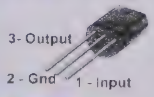
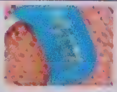
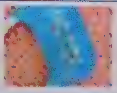
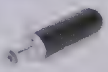
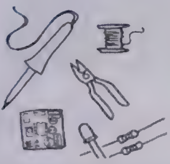
Detailed Build Steps



Install Power Supply Components

Install the Diode with the lead on the cathode (banded) end forming a hairpin lead and the anode end snugged up against the board.

Check	Designation	Component (top/bottom)	Orientation	Marking	Image	Band	Notes
☐	D3	1N4003 (top)		1N4003		any	
☐	PCB	Ensemble RX PCB (board) (top)				any	
☐	R14	68 1/6W 5% (top)	S-N	bl-gry-blk-gld		any	
☐	U07	LM78L05 voltage regulator (top)		LM78L05 ESD!!!		any	
☐	C04	4.7 uF 10% 16V X7R RAD (top)	horiz	475		any	
☐	C05	4.7 uF 10% 16V X7R RAD (top)	vert	475		any	
☐	J03	DC Power Jack PCB Mount (rt-angle) 2.5mm (top)				any	2.5mm ID
☐	P1	DC Power Plug 5.5/2.5mm Pos Ctr (top)				any	



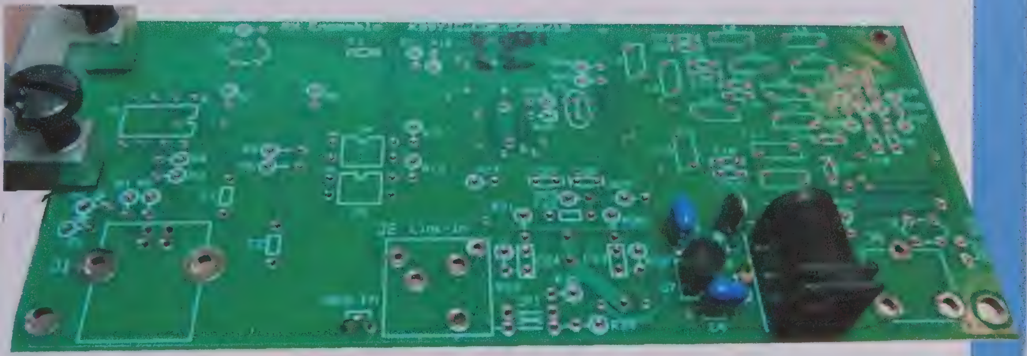
Install /RX EN (Ground Point)

Use a good strong piece of wire, as this will be used as a ground connection point for a number of tests throughout the build.

Check	Designation	Component (top/bottom)	Orientation	Marking	Image	Band	Notes
☐	/QSD EN	shunt wire (cut-off lead) (top)				any	(use for regular GND connection point)
☐	mtg_hdw	4 X #4-40 hdw (nut, bolt, washer, spacer) (top)				any	Can install later. four each of 3/8 inch 4-40 Phillips head screws,4-40 nuts, 1/8 inch long #4 nylon spacer and #4 nylon washer 1 3/8" screw, 1 nut, 1 nylon washer, and 1/18" nylon spacer (4 each)

Completed Photos

View of Completed Topside



View of Completed Underside

01_ps stage completed underside

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WB5RVZ.ORG - KITS' Documentation Home Page

Introduction

This site is the ultimate successor to my original SDR (and other) projects website, WB5RVZ.com. That site had several limitations, chief among which was the fact that the pages on the site were static.

This site contains pages, dynamically generated from a database. This will allow me to make the process of documenting band-specific variations of the same Softrock kit much easier to create and digest, while simplifying the task of maintaining the pages up-to-date.

Each project (kit) shown in this website has complete, "Heathkit-like" build documentation, in which the constructin of the kit is separated out into sequenctial build stages. Each build stage will provide some introductory material, a "sub-schematic" covering the stage's circuit details, subsets of the PCB's top and bottom layouts/silkscreens, and a listing of the sequential steps to be performed in the stage. At the end of each stage, the builder will be shown photos of the top and bottom of the pcb, as completed through that stage. Finally, the builder will be able to perform one or more stage-end tests which, when successfully passed, will give the him the confidence that he has successfully completed the stage and is ready to move on to the next stage.

Here is an example of the organization of a kit's documentation (here, the Softrock Lite II Kit):/p>

- **Power Supply**
  Steps:
    - Install SMT cap
    - Install topside components
    - Install ground test loop

  Tests:
    - Visual Inspection
    - Current Draw
    - Voltage Test
- **Local Oscillator**
  Steps:
    - Install SMT cap
    - Install Crystal
    - Install Ceramic Capacitors
    - Install transistors
    - Install Resistors

  Tests:
    - Visual Check
    - Current Draw
    - Voltage Tests
    - LO Output Test
- **Divider**
  Steps:
    - Install remainder of the SMT Capacitors
    - Install U3
    - Install U2
    - Install Hardware

  Tests:
    - Visual Check
    - Current Draw
    - Voltage Tests
    - Divider Output
    - Mixer Test
- **Operational Amplifiers**
  Steps:
    - Install OpAmp
    - Install band-specific components
    - Install remaining components

  Tests:
    - Warning
    - Visual Check
    - Current Draw
    - Voltage Tests
    - Functional Test
- **Band Pass Filter**

  Steps:
    - Install Band-specific Capacitors
    - Wind and Install Band-specific L1
    - Wind and Install band-specific T1

  Tests:
    - Visual Check
    - Inductor Continuity Tests (NO power)
    - Voltage Tests
    - Resistance Tests (no power)
    - Phasing Test (NO power)
- **Mixer**

  Steps:
    - Install Topside Components

  Tests:
    - Warning
    - Visual Inspection
    - Current Draw
    - Voltage Tests
- **External Connections**

  Steps:
    - Install Power Connection
    - Install I/Q Audio Cable Connection
    - Install Antenna Connection

  Tests:
    - Final Test

Navigation

Each kit documented in this site will have a tab on the navigation menu in this home page. There will be, for each project that has multiple band-specific options, a "Bands" tab, where the builder can select the band appropriate to the build he/she is undertaking. You must enable cookies on your browser for the band function to work.

Once you select from among the kits shown in the menu, you will be taken to the work area for the selected kit, where a new menu will be presented, allowing you to navigate between/among the pages for each build stage of the kit, as well as the home and various bill-of-materials (BOM) pages.

Web Site Responsiveness

You may find on occasion that, when switching from one page to another,

you will find there is a delay before the target page displays. This happens especially after a long period of inactivity. This the unavoidable consequence of my decision to choose a shared hosting provider for this site, in which the applications are "farmed out" across a server farm composed of many separate servers. The result is the website may get saved out to one server, and then passed on to another, which must take time to load all of the components of the site. Whadda you want for $5 per month???

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Test the Power Supply Stage

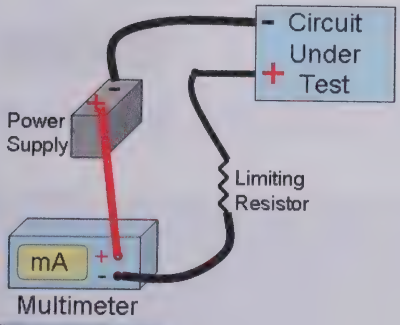
Power Supply - Current Draw

Measure the resistance (after the input diode) on the power input to ensure there is no short circuit. Measurement can be taken from the hairpin of D3 and the "/QSD EN" ground wire and should read in the Megohm range.

If the measured input resistance is within reason, measure the current draw with your mA meter inserted in series into the positive power lead.

See Tutorial on Measuring Current for an illustration of how to measure current in a circuit.

If you prefer to do so using a current limiting resistor, use something in the 1k-2k range and use ohms law to calculate the maximum current draw to expect for a direct short. Anything considerably lower than that maximum current draw would suggest there was no short



Go to Top of Page

Test Steps (if any)

Step	Test Point	UOM	Nominal	Author's	Builder's
1	D3 hairpin lead (WRT GND - "/QSD EN")	ohms	> 1M	7 M and rising	
2	Current Draw	mA	< 8	4.3	2

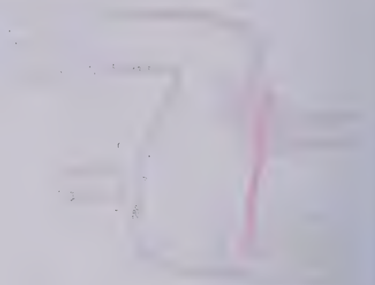
Same for LF

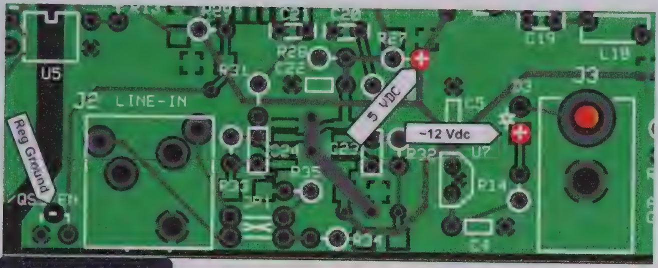
Go to Top of Page

Power Supply - Voltage Test

With 12 V dc applied to the board (author's gel cell was at 12.89 Vdc), measure the voltage after D3 and measure the output of U7 (the 5 Vdc rail)

Measurements are with respect to (WRT) the regular ground plane (i.e., the non-USB side) of the board.





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Test Steps (if any)

Step	Test Point	UOM	Nominal	Author's	Builder's
0	At Cathode of D3 (WRT regular ground)	Vdc	.6V less than input	12.3	
1 ✓	At hole for R27 hairpin lead (WRT regular ground)	Vdc	5	4.92	

Go to Top of Page

ok

Next Stage: USB Power Supply

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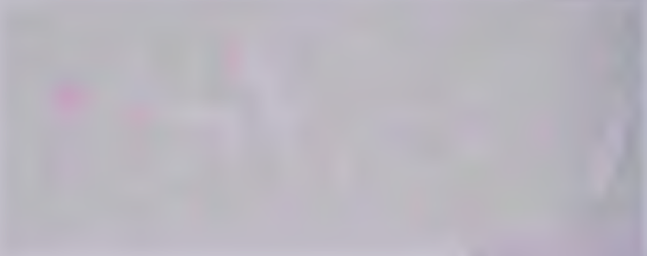

VB5RVZ.Org - Ensemble HF/LF RX II

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Ensemble RX II (HF/LF) USB Power Supply
Band: HF

Introduction

General Info About the Stage

This stage installs the power supplies for the USB section of the board. This section is galvanically isolated from the rest of the board, with its own ground plane (the "USB ground"). Voltages measured in this stage are measured with respect to (WRT) this ground and NOT the "regular ground" of the rest of the board. To paraphrase a famous city's motto, "What happens in USB stays in USB!"

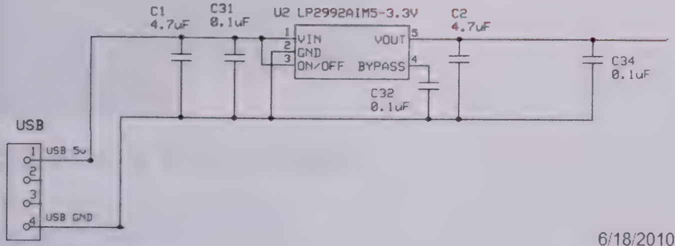
This stage installs the USB connection (with its 5 V bus) and the (very tiny) 3.3V regulator whch translates the USB 5 volts to 3.3V for the Si570 of the next stage..

This stage will present the most difficult SMT soldering challenge to the builder; that voltage regulator is, indeed, tiny! The builder should undertake this stage BEFORE that third cup of coffee and take great pains to avoid launching the little chip off into space (never to be retrieved!)

⚠ The 3.3V regulator is, indeed, very tiny. It is found in a rolled up and stapled bottom portion of an antistatic bag. You have to look very closely to find it. You do not want to do, as the author did, toss the chip out with the little rolled up bag!

Theory of Operation

Stage Schematic



6/18/2010

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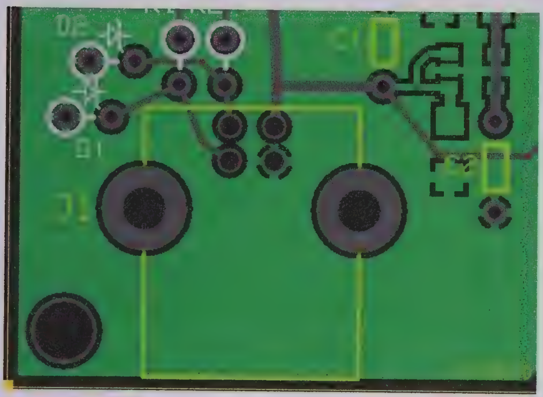
Click here for full schematic

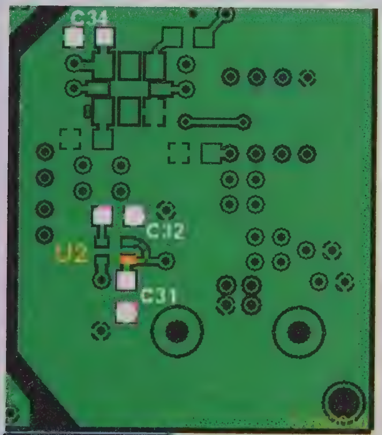
(Red dots represent the "hairpin" (or left-hand or topmost) lead of the component)

Board Layouts

Board Top



Board Bottom



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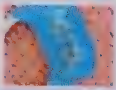
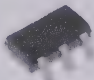
Summary Build Notes

1. Install Topside Components
2. Install Bottomside Components
3. Test the Stage

USB Power Supply Bill of Materials (HF band option)

Check	Type	Category	Component	Count	Marking	Image
☐	Capacitor	SMT 1206	0.1 uF	3	(smt) black stripe	

☐	Capacitor	Ceramic	4.7 uF 10% 16V X7R RAD	2	475	
☐	connector	Jack-RA	USB-B pcb jack (rt-angle)	1		
☐	IC	SOT-23-5	LP2992AIM5-3.3V regulator	1	LFEA ESD!!!	

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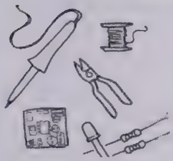
Detailed Build Steps

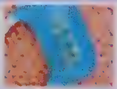
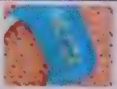


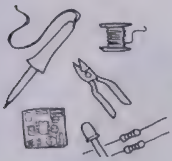
Install Topside Components

You will want to install the topside capacitors (at least) prior to attempting to solder the SMT parts on the underside (there are holes for the ceramic caps which could accidentally be clogged up if you begin with the SMT parts.

⚠ The 3.3V regulator is, indeed, very tiny. It is found in a rolled up and stapled bottom portion of an antistatic bag. You have to look very closely to find it. You do not want to do, as the author did, inadvertently toss the chip out with the little rolled up bag!

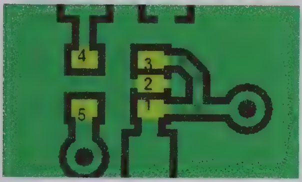
⚠ Due to some problems with recent lots of Si570 devices, Tony has had to pre-mount the Si570s and test them in circuit before sending the kit out. The circuit boards sent out with the Si570 already mounted have a cut in the trace between the 3.3 volt regulator output and the Si570. This is so that the 3.3 volt supply may be verified to be regulating properly before subjecting the Si570 to an over voltage condition. The cut needs to be bridged by scraping the ends of the trace each side of the cut and then soldering in a short wire to bridge the cutl

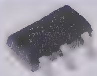
Check	Designation	Component (top/bottom)	Orientation	Marking	Image	Band	Notes
☐	C01	4.7 uF 10% 16V X7R RAD (top)	vert	475		any	
☐	C02	4.7 uF 10% 16V X7R RAD (top)	vert	475		any	
☐	J01	USB-B pcb jack (rt-angle) (top)				any	



Install Bottomside Components

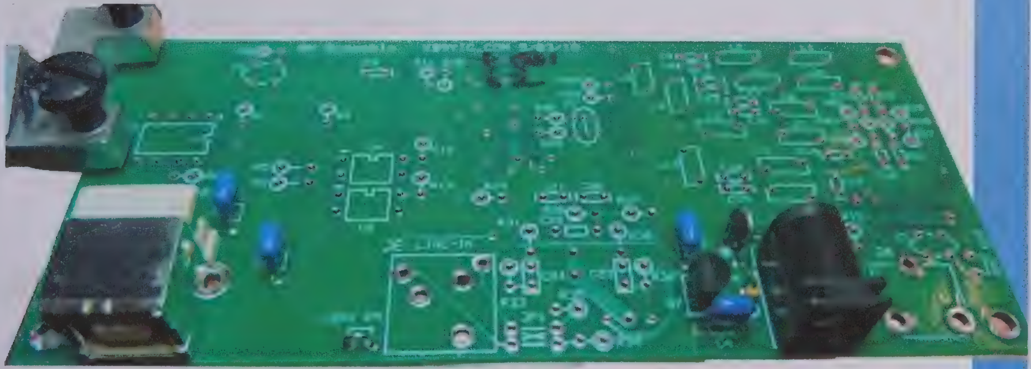
Pay careful attention to the 3.3V regulator. Pins 1 and 3 are at 5V; pin 2 is at ground and nestled snugly between pins 1 and 3.



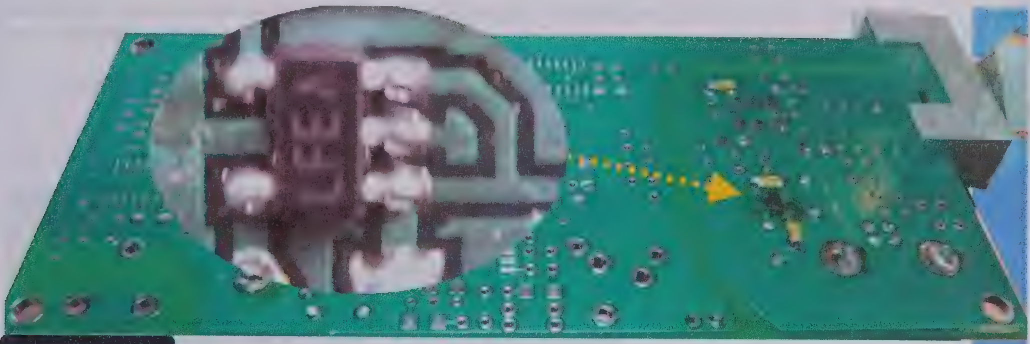
Check	Designation	Component (top/bottom)	Orientation	Marking	Image	Band	Notes
☐	U02	LP2992AIM5-3.3V regulator ((bottom))		LFEA ESD!!!		any	
☐	C34	0.1 uF ((bottom))	white pads	(smt) black stripe		any	
☐	C32	0.1 uF ((bottom))	white pads	(smt) black stripe		any	
☐	C31	0.1 uF ((bottom))	white pads	(smt) black stripe		any	

Completed Photos

View of Completed Topside



View of Completed Underside



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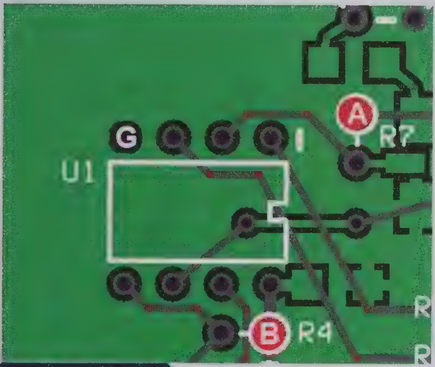
Test the USB Power Supply Stage

USB Power Supply - Test Resistances

Measure resistances on the power rails to be sure there are no short circuits.



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Test Steps (if any)

Step	Test Point	UOM	Nominal	Author's	Builder's
0	(A) 3.3V rail: R7 barrel to USB Grnd (G)	ohms	>100k	130k	
2	(B) USB 5V rail: R4 barrel to USB Ground (G)	ohms	> 1M	7M and rising	

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USB Power Supply - Voltage Test

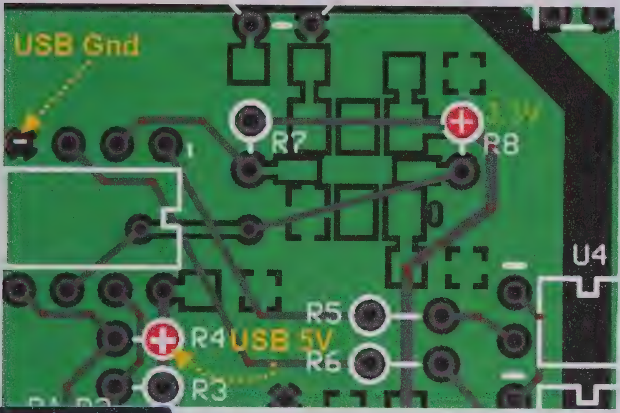
Connect the USB cable to the PC and to the board.

Measure the USB voltages (with respect to the USB ground) at the points indicated on the graphic

*Note the two test points are the **BARREL** ends, not the hairpins, of the resistors (which do not get installed until the next stage).*

TroubleShooting the 3.3V Regulator

One case was reported where the regulator tested approximately 1.8 V (as opposed to 3.3V). This was determined to be a faulty bypass capacitor (C32) bypassing pin 4 of the regulator to USB ground).



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Test Steps (if any)

Step	Test Point	UOM	Nominal	Author's	Builder's
0	3.3V point R8 (BARREL end - WRT USB Ground)	Vdc	3.3	3.29	
1	USB 5V: R4 (BARRELL end - WRT USB Ground)	Vdc	5	5.02	

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Next Stage: Local Oscillator

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note date — has been updated

Ensemble RX II LF/HF RX Home

Home Bill of Materials Power Supply USB Power Supply Local Oscillator and Control Quadrature Clock Generator Auto Band Pass Filters Quadrature Sampling Detector Operational Amplifiers Comments Acronyms Inventory Revisions as of 7/19/2012 Components By Stage WB5RVZ Main Website

Search: Search selected SDR sites

LF/HF RX Home Introduction

General

The Ensemble RX LF/HF kit and its 4.5: X 2" board representing the culmination of a long line of Softrock SDR receivers from . The line began with the Softrock 40 RX and went through several iterations of receivers. The most recent receiver was the with anautomatically switched bandpass filter. This current kit is a refinement on that kit and further streamlines the kitting process for Tony Parks, the designer and supplier.

Printable Builders Notes

These notes have been rendered to a and printed for those who prefer to work off of printed notes. Please be advised that priority is given to keeping the website up to date and occasionally, the pdf version can get out of synch. When in doubt, the builder should compare the web-based revision dates, schematics , bom summary inventories, and component-by-stage inventories (web vs pdf) to resolve any discrepancies.

HF Option

The Ensemble RX LF/HF kit provides coverage of HF ham bands from 160-10m, in four different optional "super bands" (each with underlap and overlap within the parameters of the associated bandpass filter):

1. Band 0: 160m - Continuous coverage from 1.8 to 2.0 MHz
2. Band 1: 80m and 40m - Continuous coverage from 3.5 to 7.3 MHz
3. Band 2: 30m, 20m, and 17m - Continuous coverage from 10.1 to 18.168 MHz
4. Band 3: 15m, 12m, and 10m - Continuous coverage from 21.0 to 29.7 MHz

LF Option

The Ensemble RX LF/HF kit provides the option of coverage of LF frequencies from approximately 160-10m, in four different optional "super bands" (each with underlap and overlap within the parameters of the associated bandpass filter):

1. Band 0: 1000m - Continuous coverage from 180 kHz to 480 kHz
2. Band 1: 500m - Continuous coverage from 400 kHz to 800 kHz

3. Band 2: 250m - Continuous coverage from 800 kHz to 1.6 MHz
4. Band 3: 160m - Continuous coverage from 1.6 MHz to 3.0 MHz

The band coverage is via 4 switchable "bands" ("superbands"). Band switching is performed under program control, in conjunction with programmatic control of the receive frequency. This control is provided by an Atmel ATTiny85 micro-controller, acting as a USB device to control the Si570 programmable oscillator and automatically switch to the appropriate band (0-3) as the frequency changes.

As a welcome improvement over other models, this kit provides pcb-right-angle jacks for all external connections: Antenna, USB from the PC, I/Q output to the PC, and Power to the Board. Thus, once built, the kit can be placed in a suitable enclosure and handled thereafter as a "blackbox peripheral" to the PC.

The design of the Ensemble RX is very similar to the receiver design of its sibling .
The major difference is the greater band coverage of the Ensemble RX kit (roughly 4 "superbands" on the RX vs. 1 "superband" on the RXTX).

This kit is an excellent value for both the licensed amateur and the SWL who is comfortable with building electronics kits. The skill level and experience requirements are medium-level because of the small size of the components, the requirement to be able to solder SMT parts, and the requirement to wind and install inductors. Thousands of builders have proven this is not an insurmountable set of requirements. If you are new at this, you should try one of Tony's sub $20 monobander RX kits as a "starter/learner" kit.

Several hams have provided interesting/informative galleries of photos as they have followed these build notes:

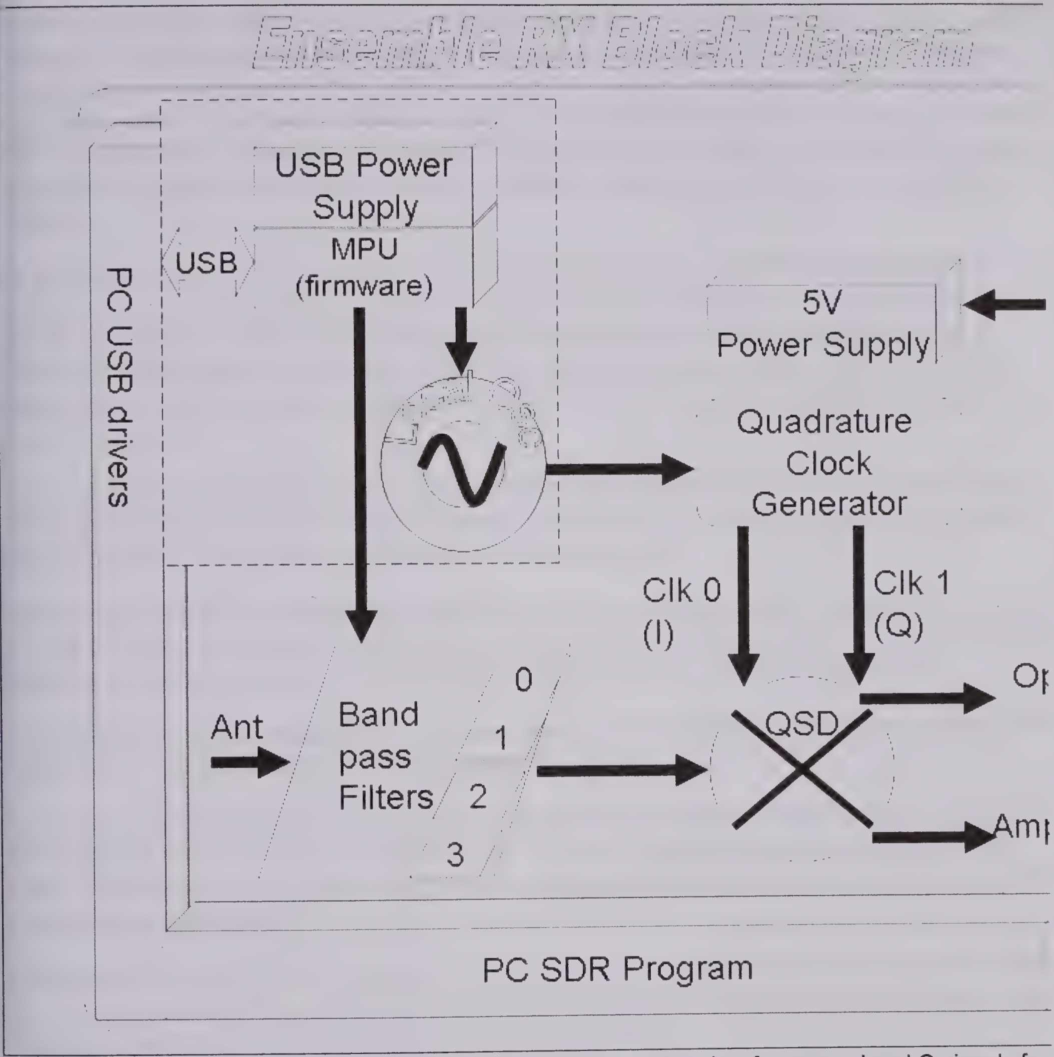
•

Recommended Enclosure

Basic Theory

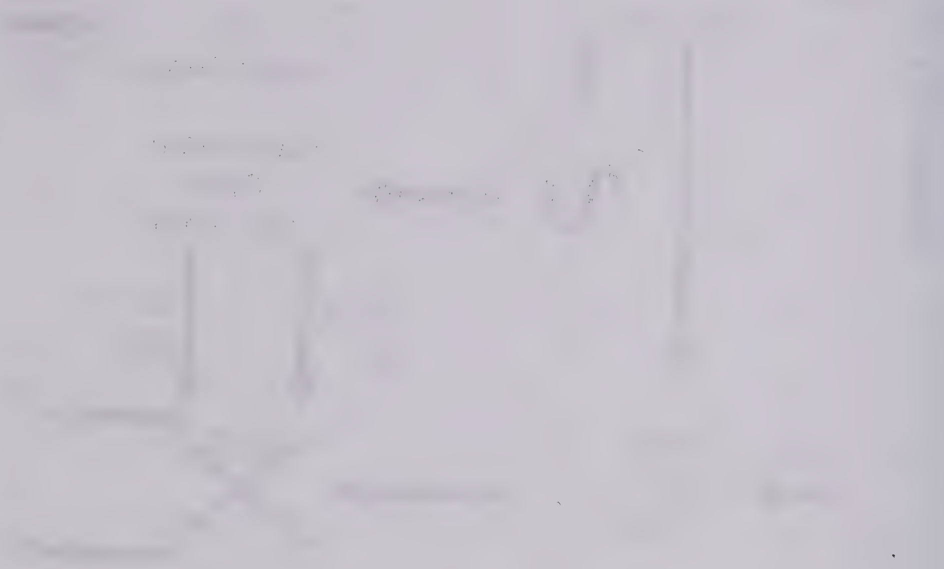
For a very readable (if somewhat dated) presentation of the fundamentals of SDR receivers, see the

Block Diagram



This receiver implements a quadrature sampling detector to produce low frequency I and Q signals for input to the stereo line in inputs of a PC sound card. The I and Q signals are the product of the quadrature sampling detector (QSD) stage, in which bandpass filtered "chunks" of RF are mixed with quadrature clock signals to produce the down-converted I and Q signals. These products (the I and Q pairs) are identical to each other in all respects except phase, where they are 90 degrees apart.

The I/Q products of the QSD ("mixer"), when input to the appropriate SDR program through the PC's STEREO line-in soundcard input, result in a spectrum display on the PC which will show signals arrayed around a "center frequency". This "center frequency" is the frequency of the I/Q outputs from the Quadrature Clock Generators. The bandwidth of the signals either side of the center frequency will be approximately equal to the sampling rate of the PC's sound card. Thus, if the local oscillator is



uned to produce 28.4 MHz to the Quadrature Clock Generators, they will output two signals (I and Q clocks) at 7.1MHz (the "center frequency"). If the PC's sound card has a 48 kHz sampling rate, then the SDR program can translate the QSD's I/Q outputs into a chunk of spectrum that is 24 kHz either side of the center frequency of 7.1 MHz: i.e, 7.076 - 7.124 MHz. If the LF Option is built (by eliminating the HF Jumper and installing the second 74AC74 IC to allow for a divide-by-16), the center frequency resulting from a local oscillator frequency of 3.5 MHz (the lowest for the Si570) will be approximately 218 kHz.

As the user tunes the receiver, varying the frequency of the local oscillator, the micro-controller tracks the frequency and switches the appropriate bandpass filter into the RF chain. The SDR program's display will update to show the new center frequency and adjust the scale to reflect the current +/- bandwidth around that center frequency. At all times, the operator can see all signals that are within this movable "window" (whose total width is 48, 96, or 192 kHz, depending upon the sampling rate of the PC's soundcard).

The receiver is controlled via a USB connection from the PC. This USB connection provides a "USB 5V" bus for the local oscillator and micro-controller. A separate 3.3 V voltage regulator on the 5 USB 5 volt bus provides power to the programmable oscillator, the Si570.

The RX has an Atmel ATTiny85 micro-controller unit which, acting as a USB device, and on the "USB 5V" rail, controls the frequency output of the programmable local oscillator (Si570) and provides two switching signals which can be used to select one of four filter banks in the band pass filter

The output of the local oscillator is at a frequency which is 4 times the desired center frequency of the receiver and is consumed in the Quadrature Clock Generators.

The Quadrature Clock Generators divides the local oscillator frequency by 4 (or, for the LF option, by 16) to produce two clock signals - QSE Clk 0 and QSE Clk 1 - which will be used to clock the QSD stage. These I and Q clock signals are identical in all respects but phase (they are in quadrature - 90 degrees phase separation).

Rf at the antenna jack is filtered through the Bandpass Filter Stage, where one of four "chunks" of the HF (or LF) band is selected by the micro-controller, based upon the tuning of the programmable Local Oscillator. The filtered RF is passed as input to the QSD Stage.

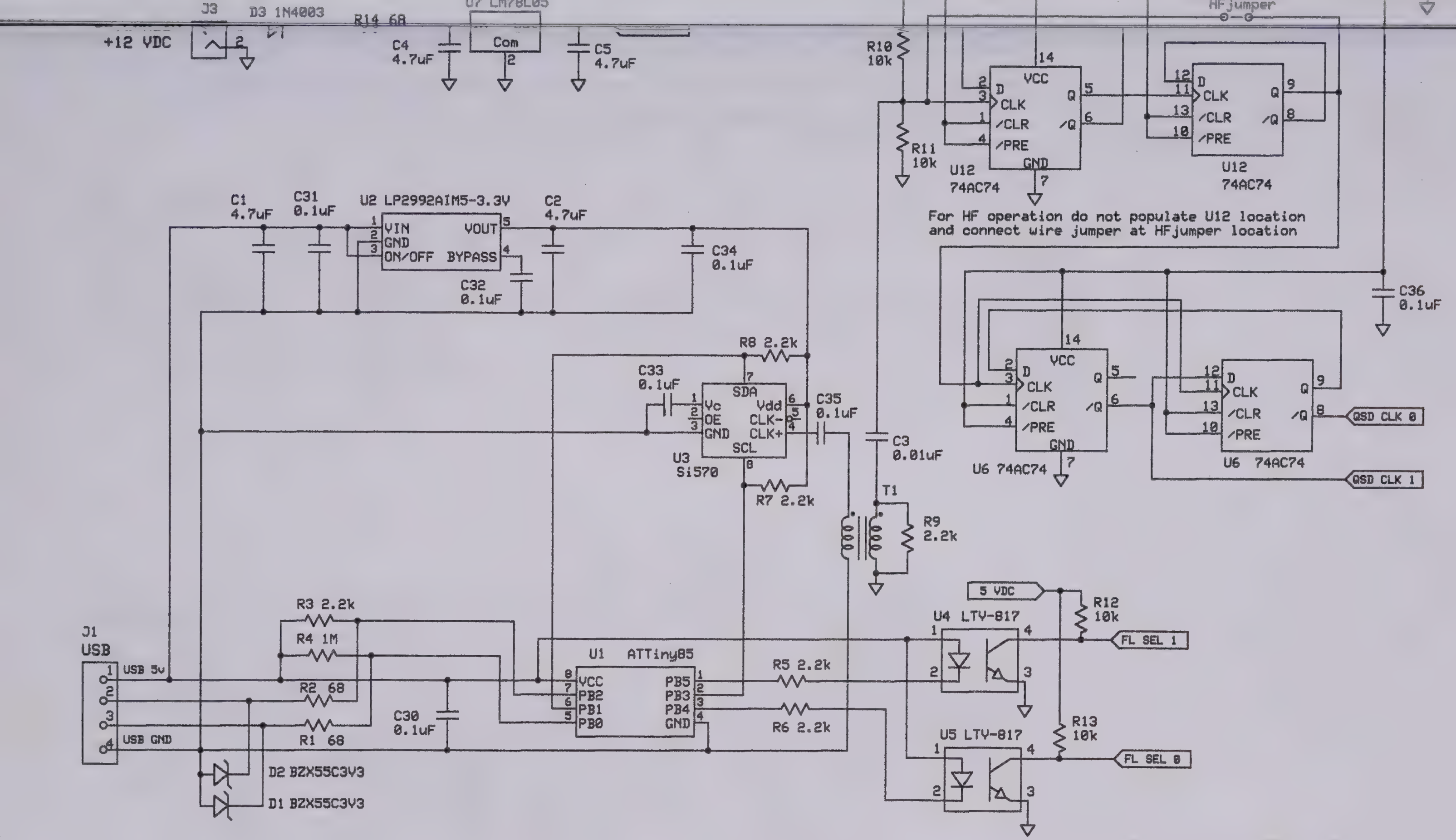
The Quadrature Sampling Detector (QSD) Stage acts very similar to a mixer. It incorporates a high-speed switch that is clocked by the two QSD clock signals from the Quadrature Clock Generators and switches the incoming RF into a RC sampling network. The result is two outputs at low frequency and also in quadrature, which are the down-converted, baseband analogs of the incoming RF signals.

The outputs of the QSD stage are then fed into a pair of high gain Operational Amplifiers to produce the I and Q baseband signals which will be input to the PC soundcard's stereo Line In.

( )

LF/HF RX Home Schematic

(Resistor testpoints (hairpin, top, or left-hand lead), as physically installed on the board, are marked in the schematic with red dots)

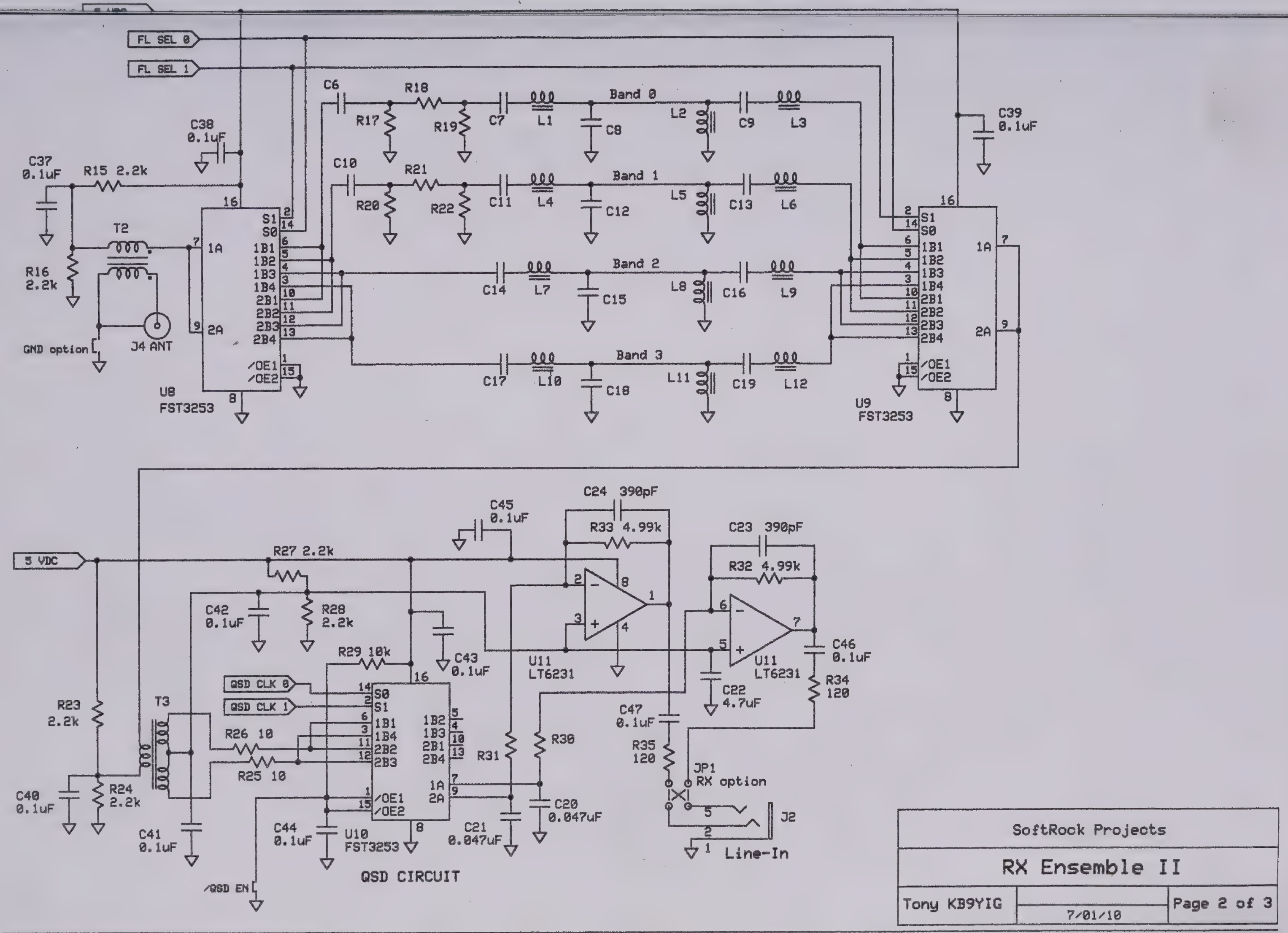


For HF operation do not populate U12 location
and connect wire jumper at HFjumper location

SoftRock Projects

RX Ensemble II

Tony KB9YIG | 7/01/10 | Page 1 of 3



SoftRock Projects

RX Ensemble II

Tony KB9YIG

7/01/10

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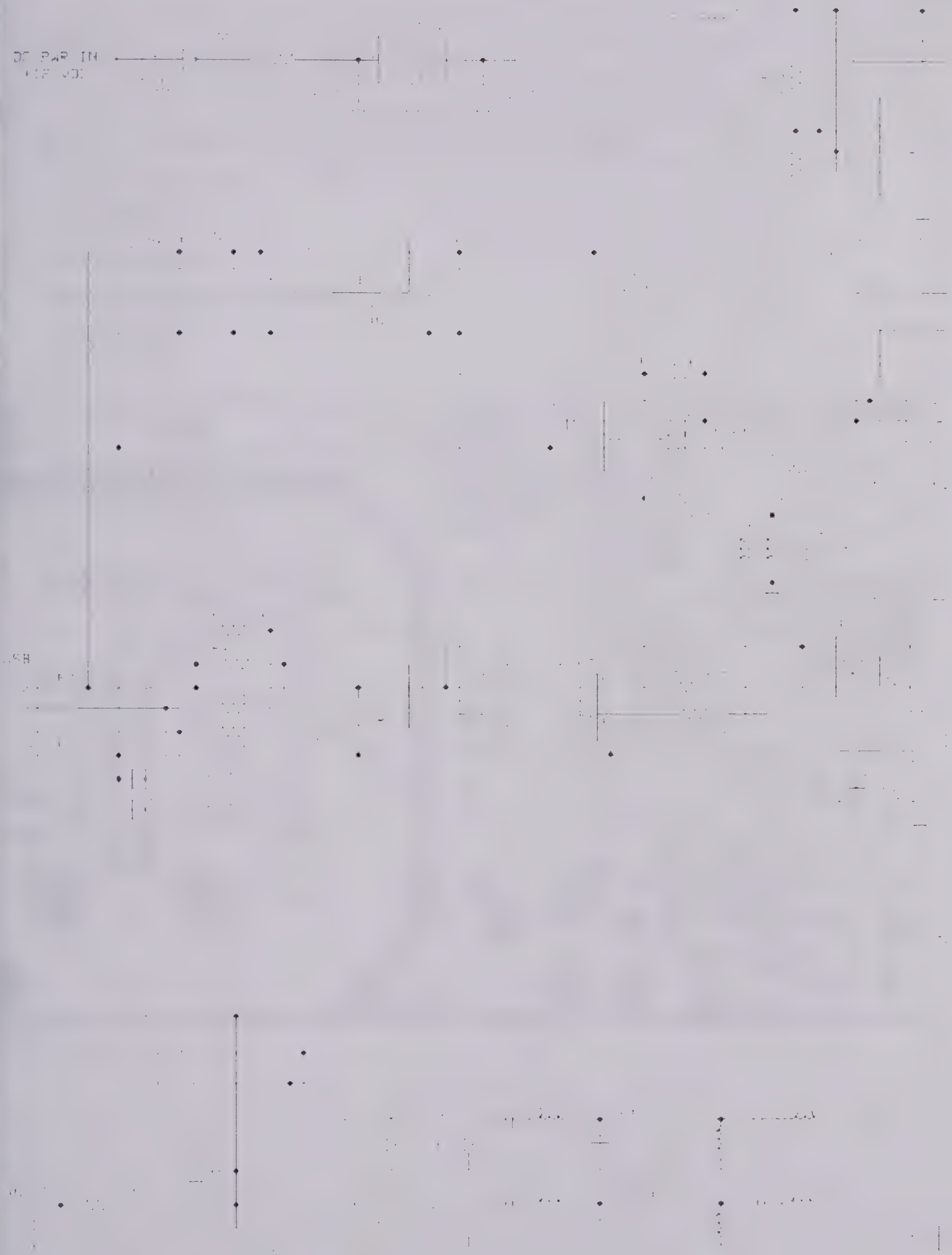

DC PWR IN
+12 VDC
USB

(above schematic has clickable areas that can be used for navigation)

( )

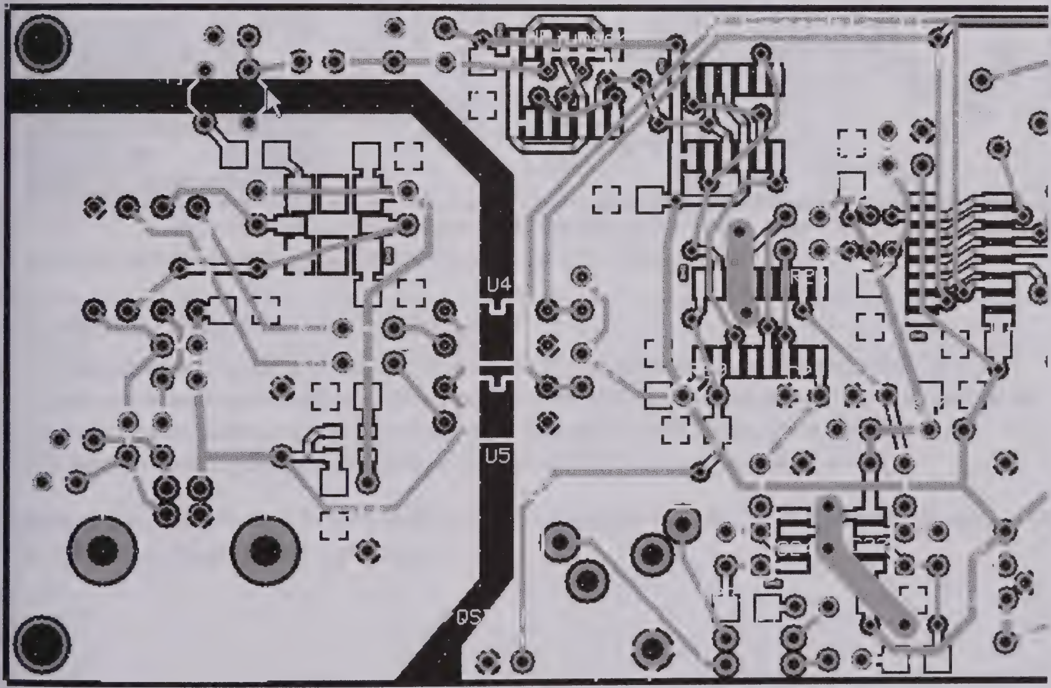
LF/HF RX Home Bill of Materials

See

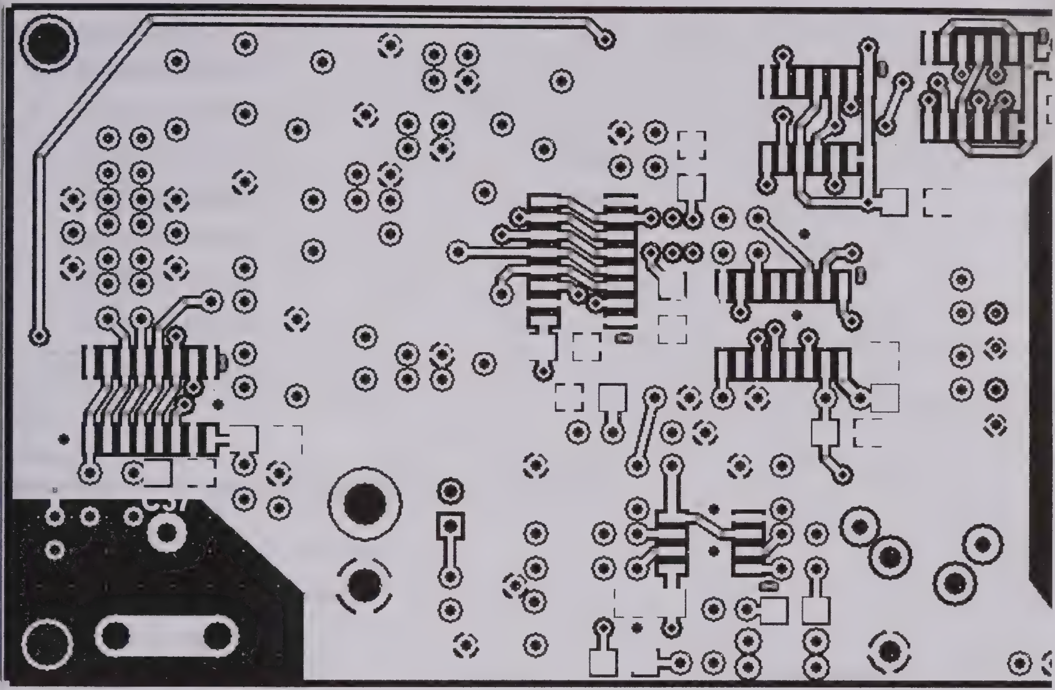
LF/HF RX Home Expert's (terse) Build Notes

- Review schematics: and
- Build USB Side
- Build Auto BPFs
- Build QSD Clocks, Mixers, and OpAmps
- Operate Radio

Board Top



Board Bottom



(Note: 0.1 uF SMT caps are mounted to the WHITE pads; 0.01 uF caps mount to YELLOW cap pads - do not conuse these with the yellow identification of the "1" pins for the ICs.)

Project Detailed Build Notes

For the non-expert builders among us, this site takes you through a stage-by-stage build of the kit. Each stage is self-contained and outlines the steps to build and test the stage. This ensures that you will have a much better chance of success once you reach the last step, since you will have successfully built and tested each preceding stage before moving on to the next stage.

Each stage is listed below, in build order, and you can link to it by clicking on its name below (or in the header and/or footer of each web page).

- Inventory the
- Build and Test the [illegible] Stage
- Build and Test the [illegible] Stage
- Build and Test the [illegible] Stage
- Build and Test the [illegible] Stage
- Build and Test the [illegible] Stage
- Build and Test the [illegible] Stage
- Build and Test the [illegible] Stage

Background Info

Tools

Winding Inductors

To learn how to wind coils and transformers, please read the

- and then
- view the excellent videos on
- or take a read of
- You can review the [illegible] for details on deciphering the winding specifications, core specifications,and construction of toroidal and binocular inductors.

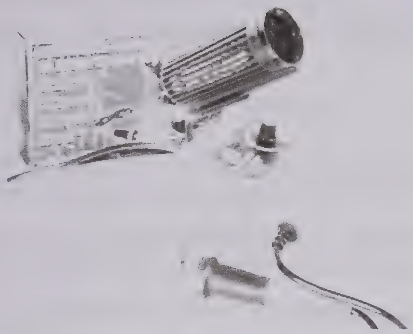
Soldering

If you are not experienced at soldering (and even if you are somewhat experienced at soldering), refer to

The video below describes techniques for soldering SOIC 14 (and 16 and 8) SMDs

For the more adventurous, there is a process using solder paste and an electric oven called the reflow process, which can be used to install all the SMT chips to one side of the PC Board. This is documented by Guenael Jouchet in the following Youtube segment:

- Read the at the Sparkfun site. It is a very good read and it speaks great truths. Then take the time to watch the .
- . Don't skimp here. Soldering deficiencies account for 80 percent of the problems surfaced in troubleshooting. It is preferable to have an ESD-safe station, with a grounded tip. A couple of good stations that are relatively inexpensive are:



- Velleman (approx $20 at Frys) ( )

- Haakko 936

ESD Protection

You may wish to review the message topic beginning at for a common-sense discussion on ESD.

- Avoid carpets in cool, dry areas.
- Leave PC cards and memory modules in their anti-static packaging until ready to be installed.

- Dissipate static electricity before handling any system components (PC cards, memory modules) by touching a grounded metal object, such as the system unit unpainted metal chassis.
- If possible, use antistatic devices, such as (see for $25 or the for $15)).
- Always hold a PC card or memory module by its edges. Avoid touching the contacts and components on the memory module.
- Before removing chips from insulator, put on the wrist strap connected to the ESD mat. All work with CMOS chips should be done with the wrist strap on.
- As an added precaution before first touching a chip, you should touch a finger to a grounded metal surface.
- If using a DMM, its outside should be in contact with the ground of the ESD mat, and both leads shorted to this ground before use.
- See the review of ESD Precautions at this .

Work Area

- You will need a well-lit work area and a minimum of 3X magnification (the author uses a cheap magnifying fluorescent light with a 3X lens. This is supplemented by a hand-held 10 X loupe - with light - for close-in inspection of solder joints and SMT installation.
- You should use a cookie sheet or baking pan (with four sides raised approximately a half an inch) for your actual work space. It is highly recommended for building on top of in order to catch stray parts, especially the tiny SMT chips which, once they are launched by an errant tweezer squeeze, are nigh on impossible to find if they are not caught on the cookie sheet.

Misc Tools

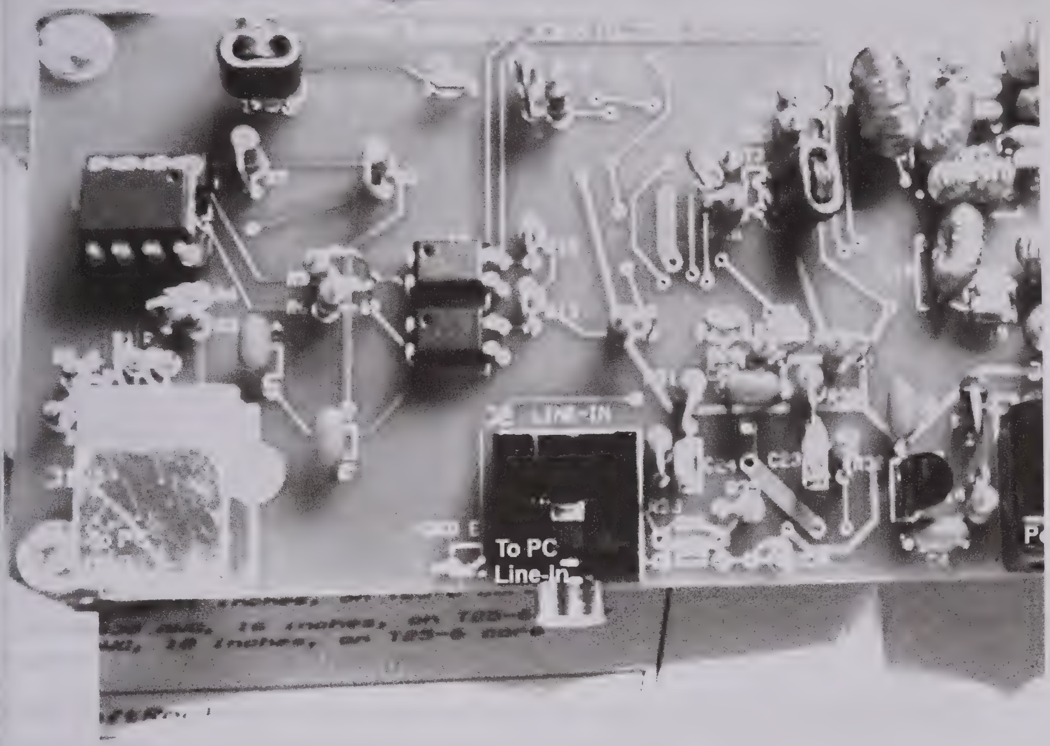
- It is most important to solidly clamp the PCB in a holder when soldering. A "third-hand" (e.g., or the) can hold your board while soldering. In a pinch, you can get by with a simple . Jan G0BBL suggests "A very cheap way is to screw a Large Document Clip to a woodblock which will clamp the side of a PCB."
-
- Tweezers (bent tip is preferable).
- A toothpick and some beeswax - these can be used to pickup SMT devices and hold them steady while soldering.
- Diagonal side cutters.
- Small, rounded jaw needle-nose pliers.
- Set of jewelers' screwdrivers
- An Exacto knife.
- Fine-grit emery paper.

LF/HF RX Home Completed Stage

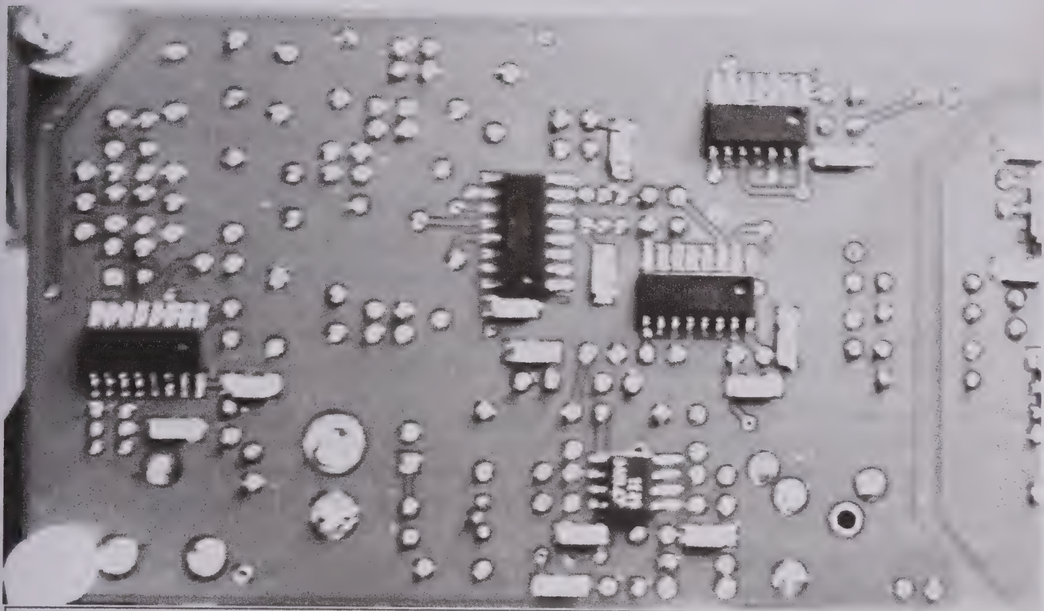
(These photos were of an earlier board design. It has changed since the author built the kit upon

which these notes are based. The board layout graphics are, however, current.)

Top of the Board



Bottom of the Board



LF/HF RX Home Testing

Each stage will have a "Testing" Section, outlining one or more tests that, when successfully completed, provide you with the confidence and assurance that you are heading in the right direction towards a fully tested and built transceiver.

When you perform a test, you should always record the results of the test where indicated in the Testing section. This will make troubleshooting via the reflector much easier, since you will be communicating with the experts using a standard testing and measurement regime.

It goes without saying that you should ALWAYS precede any tests with a very careful, minute inspection (using the best light and magnification available to you) to be sure all solder joints are clean and there are no solder bridges or cold joints.

This kit can be built and reliably tested using nothing more than a common multimeter. Tests assume that the builder has a decent digital multimeter of sufficiently high input impedance as to minimize circuit loading issues. Measurements will be taken of current

draws, test point voltages, and resistances.

Most stages will have a current draw test, in which the builder tests the stage's current draw in two different ways:

- First, testing the draw through a current-limiting resistor
- Then, when that test is OK, removing the current-limiting resistor and measuring the real current draw.

Some tests will require you to use your ham radio to receive or generate a signal of a specified frequency in order to test transmitters, oscillators, dividers, and/or receivers.

Optional testing. If the builder has (access to) a dual channel oscilloscope, along with an audio signal generator and an RF signal generator, and feels the need to perform tests beyond the basic DMM tests, certain stages will include in their testing section some optional tests involving this advanced equipment.

The or programs available free from Michael Keller, DL6IAK, can be used in a pinch to get the sound card to produce audio tones for injection into the circuit.

You can always use Rocky to generate I and Q signals for tests requiring these audio signals (this is the author's preferred way)

Home Bill of Materials Power Supply USB Power Supply Local Oscillator and Control Quadrature Clock Generator Auto Band Pass Filters Quadrature Sampling Detector Operational Amplifiers Comments Acronyms Inventory Revisions as of 7/19/2012 Components By Stage WB5RVZ Main Website

Ensemble RX II 01_Power Supply

Search: Search selected SDR sites

Power Supply Introduction

General

This stage supplies the "regular" 5 volt power rail, for powering the CMOS chips on the main part of the board.

Note: throughout these notes, they will refer to the board in terms of:

- Topside: the side where one can read the silk-screened component designations and outlines
- Bottomside: the reverse of topside, where the SMT components are installed
- Bottom or "bottom edge": the edge of the board where all of the connectors are located
- Top or "top edge": the edge of the board opposite of the bottom edge

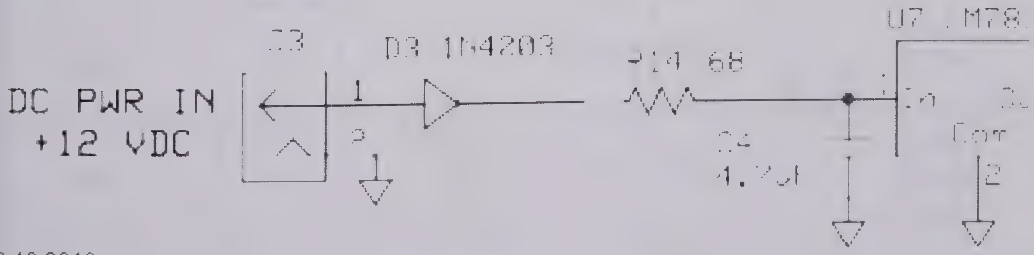
Unlkess otherwise noted, all photos/graphics of the board layout are displayed herein with the top edge UP.

( )

Power Supply Schematic

(Resistor testpoints (hairpin, top, or left-hand lead), as physically installed on the board, are marked in the schematic with red dots)

( )



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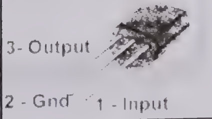
( )

Power Supply Bill of Materials

Stage Bill of Materials

(resistor images and color codes courtesy of 's)

Check	Designation	Component	Marking	Category	Orientation	Notes	Circuit
☐	/QSD EN	shunt wire (cut-off lead)		Cutoff		(use for regular GND connection point)	Power Supply
☐	D3		1N4003	Axial			Power Supply
☐	mtg_hdw	4 X #4-40 hdw (nut, bolt, washer, spacer)		HDW		Can install later. four each of 3/8 inch 4-40 Phillips head screws,4-40 nuts, 1/8 inch long #4 nylon spacer and #4 nylon washer	Power Supply
☐	PCB	Ensemble RX PCB (board)		Main Board			Power Supply
☐	R14	68 1/6W 5%	bl-gry-blk-gld	1/6W	S-N		Power Supply
☐	U07		LM78L05 	TO-92			Power Supply
☐	C04		475	Ceramic	horiz		Power Supply
☐	C05		475	Ceramic	vert		Power Supply

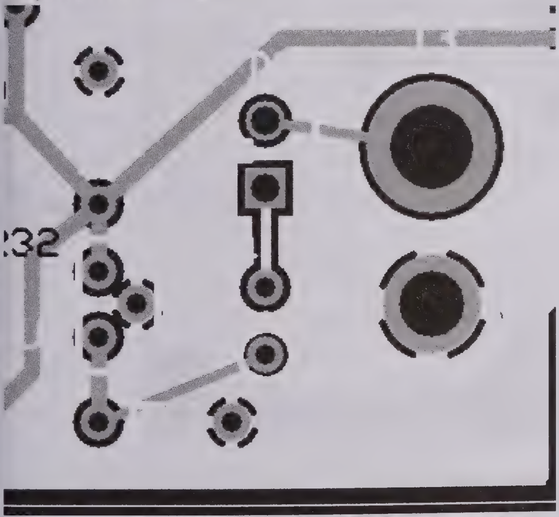
☐	J03	DC Power Jack PCB Mount (rt-angle)		Jack-RA			Power Supply
☐	P1	DC Power Plug 5.5/2.1mm Pos Ctr		Plug			Power Supply

Power Supply Summary Build Notes

- Install Power Supply Components
- Install /RX EN (Ground Point)
-

Power Supply Detailed Build Notes

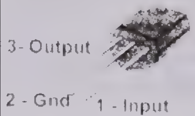
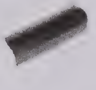
Top of the Board



Install Power Supply Components

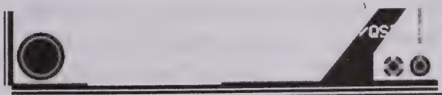
Install the Diode [illegible]

Check	Designation	Component	Marking	Category	Orientation	Notes
☐	D3		1N4003 	Axial		
☐	PCB	Ensemble RX PCB (board)		Main Board		

☐	R14	68 1/6W 5%	bl-gry-blk-gld	1/6W	S-N	
☐	U07		LM78L05 	TO-92		T
☐	C04		475	Ceramic	horiz	
☐	C05		475	Ceramic	vert	
☐	J03	DC Power Jack PCB Mount (rt-angle)		Jack-RA		
☐	P1	DC Power Plug 5.5/2.1mm Pos Ctr		Plug		

Install /RX EN (Ground Point)

[illegible]



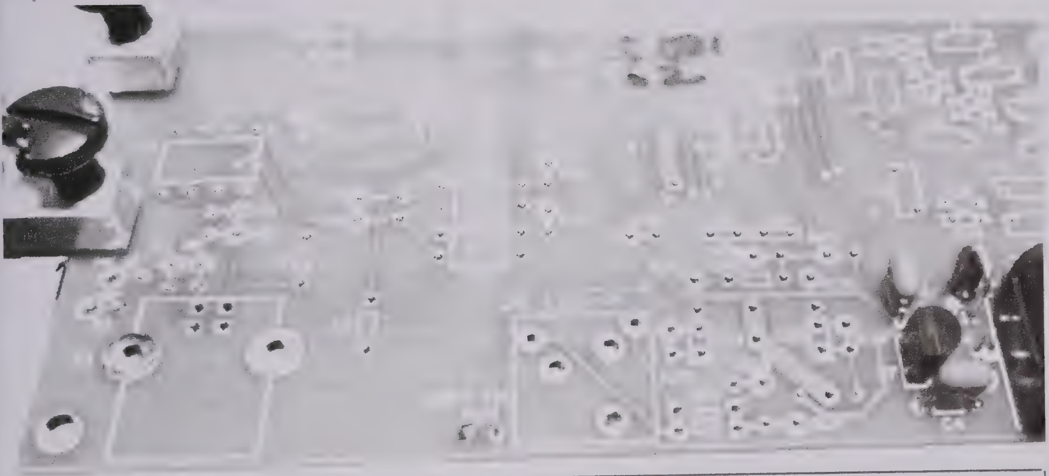
Check	Designation	Component	Marking	Category	Orientation	Notes
☐	/QSD EN	shunt wire (cut-off lead)		Cutoff		(use for regular GND connection point)
☐	mtg_hdw	4 X #4-40 hdw (nut, bolt, washer, spacer)		HDW		Can install later. four each of 3/8 inch 4-40 Phillips head screws,4-4(nuts, 1/8 inch long #4 nylon spacer and

#4 nylon washer

Power Supply Completed Stage

(These photos were of an earlier board design. It has changed since the author built the kit upon which these notes are based. The board layout graphics are, however, current.)

Top of the Board



Power Supply Testing

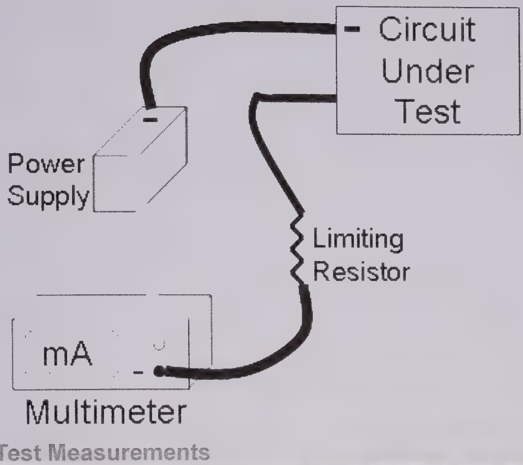
Current Draw

Test Setup

Measure the resistance (after the input diode) on the power input to ensure there is no short circuit. Measurement can be taken from the hairpin of D3 and the "/QSD EN" ground wire and should read in the Megohm range.

If the measured input resistance is within reason, measure the current draw with your mA meter inserted in series into the positive power lead.

See for an illustration of how to measure current in a circuit.



Test Measurements

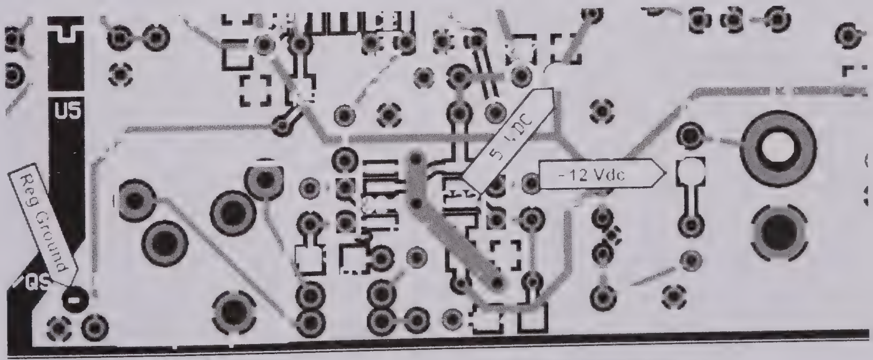
Testpoint	Units	Nominal Value	Author's	Yours
D3 hairpin lead (WRT GND - "/QSD EN")	ohms	> 1M	7 M and rising	
Current Draw	mA	< 8	4.3	

Voltage Test

Test Setup

With 12 V dc applied to the board (author's gel cell was at 12.89 Vdc), measure the voltage after D3 and measure the output of U7 (the 5 Vdc rail)

Measurements are with respect to (WRT) the regular ground plane (i.e., the non-USB side) of the board.



Test Measurements

Testpoint	Units	Nominal Value	Author's	Yours
At Cathode of D3 (WRT regular ground)	Vdc	.6V less than input	12.3	

At hole for R27 hairpin lead (WRT regular ground)	Vdc	5	4.92	

Ensemble RX II 03_Local Oscillator and Control

Home Bill of Materials Power Supply USB Power Supply Local Oscillator and Control Quadrature Clock Generator Auto Band Pass Filters Quadrature Sampling Detector Operational Amplifiers Comments Acronyms Inventory Revisions as of 7/19/2012 Components By Stage WB5RVZ Main Website

Search: Search selected SDR sites

Local Oscillator and Control Introduction

General

This stage completes the component installation for the isolated USB ground plane and implements:

- the microcontroller and
- the local oscillator functionality.

The microcontroller implements a USB device which can control frequency of the programmable oscillator (Si570) and provides programmatic band-select switching signals to select from among bands 0, 1, 2, and 3. These bands are "super bands" which, depending upon the builder's choice of options, provide coverage of the traditional HF bands or a set of HF bands plus 6m.

⚠ *It is important to remember that the Local Oscillator does not output at the desired center frequency for your band; it produces an output at a frequency that is:*

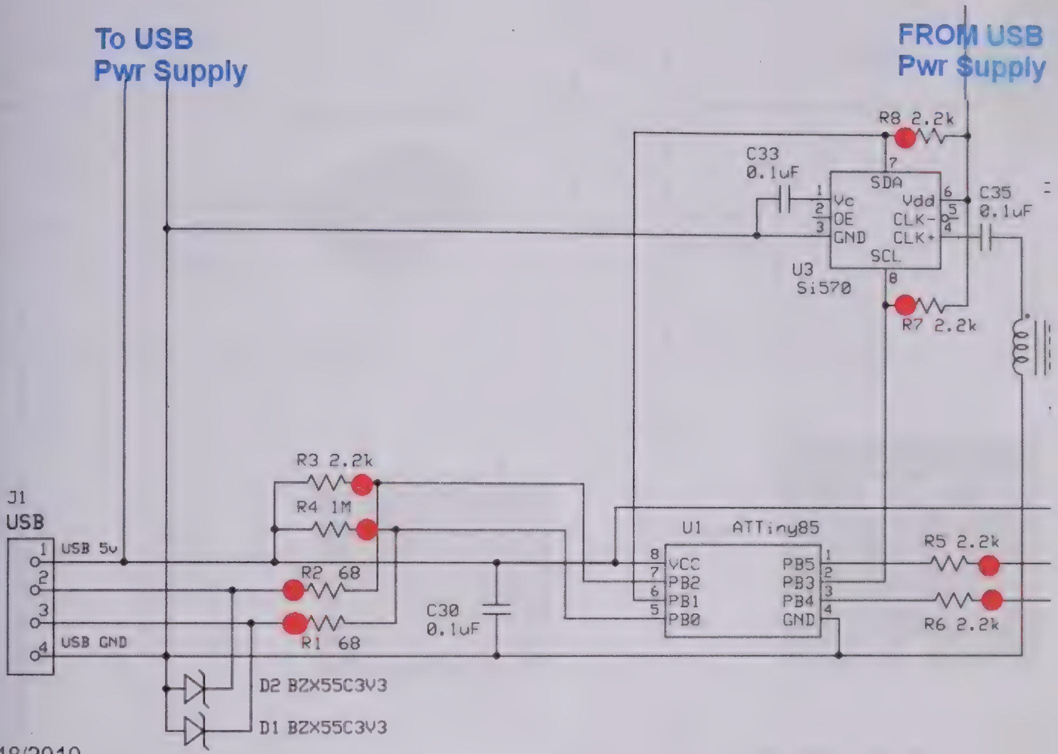
- *For the HF option, 4 times the desired center frequency*
- *For the LF optikon, 16 times the desired center frequency*

(go directly to build notes)

Local Oscillator and Control Schematic

(Resistor testpoints (hairpin, top, or left-hand lead), as physically installed on the board, are marked in the schematic with red dots)

(Click for Full Schematic)



6/18/2010

(above schematic has clickable areas that can be used for navigation)

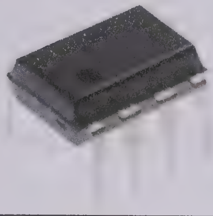
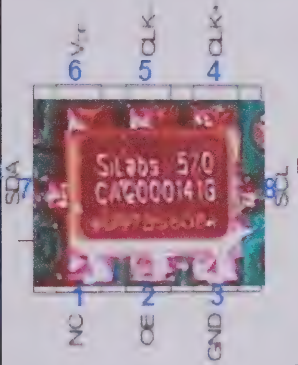
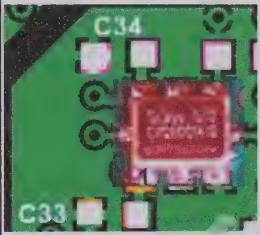
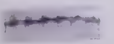
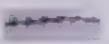
(go directly to build notes)

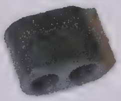
Local Oscillator and Control Bill of Materials

Stage Bill of Materials

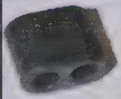
(resistor images and color codes courtesy of Wilfried, DL5SWB's R-Color Code program)

Check	Designation	Component	Marking	Category	Orientation	Notes
☐	D1	BZX55C3V3 3.3V zener diode	BZX55C	Axial		The band end of the diode i hairpin lead - see board lay
☐	D2	BZX55C3V3 3.3V zener diode	BZX55C	Axial		The band end of the diode i hairpin lead - see board lay
☐	magwire	Magnetic Wire, enameled #30		Magnetic		(total of 30 ft. provided in kit

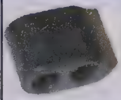
☐	SO1	8 pin dip socket		Socket		for ATTiny85
☐	U01	ATtiny 85-20 PU w/V15.12 Firmware	AVR ATTINY85-20PU 	DIP 8	(dimple in upper right)	
☐	U03	Si570 Programmable Oscillator	SiLabs 570  V+ CLK+ CLK- 6 5 4 SDA 7 SiLabs 570 CA2000141G 8 SCL 1 2 3 NC OE GND	I2C		
☐	U04	LTV-817 Opto-Isolator	LTV 817	DIP-4	(dimple in upper left)	
☐	U05	LTV-817 Opto-Isolator	LTV 817	DIP-4	(dimple in upper left)	
☐	C03	0.01 uF	103	Ceramic	horiz	
☐	C30	0.1 uF	(smt) black stripe	SMT 1206	white pads	
☐	C33	0.1 uF	(smt) black stripe 	SMT 1206	white pads	
☐	C35	0.1 uF	(smt) black stripe 	SMT 1206	white pads	

☐	R01	68 1/6W 5%	bl-gry-blk-gld	1/6W	N-S	
☐	R02	68 1/6W 5%	bl-gry-blk-gld	1/6W	N-S	
☐	R03	2.2k 1/6W 5%	red-red-red-gld	1/6W	E-W	
☐	R05	2.2k 1/6W 5%	red-red-red-gld	1/6W	W-E	
☐	R06	2.2k 1/6W 5%	red-red-red-gld	1/6W	W-E	
☐	R07	2.2k 1/6W 5%	red-red-red-gld	1/6W	N-S	
☐	R08	2.2k 1/6W 5%	red-red-red-gld	1/6W	N-S	
☐	R09	2.2k 1/6W 5%	red-red-red-gld	1/6W	W-E	chenged from 221
☐	R12	10 k 1/6W 5%	brn-blk-ora-gld	1/6W	N-S	
☐	R13	10 k 1/6W 5%	brn-blk-ora-gld	1/6W	N-S	
☐	R04	1 M 1/6W 5%	brn-blk-grn-gld	1/6W	E-W	
☐	T01-core	BN-43-2402 (no markings!)	 none	Binocular core		
☐	T01	band-specific		misc		change from 3Ttrifilar

Band Specific Items for HF Band

Check	Designation	Component	Marking	Category	Orientation	Notes	Circuit
☐	T01	5.76uH: 2T(bi)T #30(8 (2x4)in) on BN43-2402		xfrmr		change from 3Ttrifilar	Local Oscillator and Control

Band Specific Items for LF Band

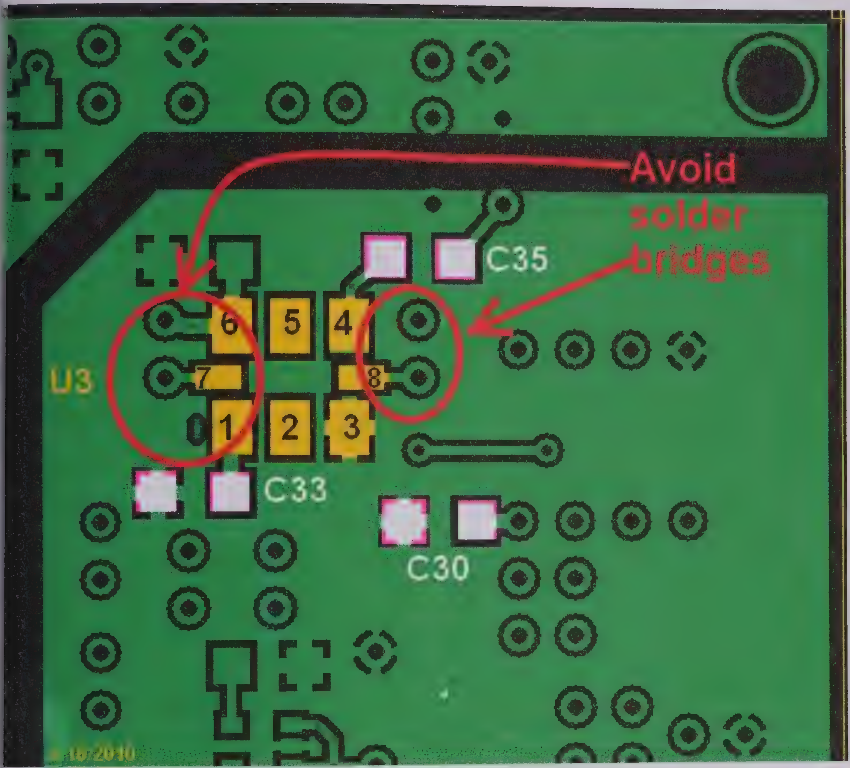
Check	Designation	Component	Marking	Category	Orientation	Notes	Circuit
☐	T01	12.96uH: 3T(bi)T #30(10 (2x5)in) on BN43-2402		xfrmr		change from 3Ttrifilar	Local Oscillator and Control

Local Oscillator and Control Summary Build Notes

- Install Protective Topside Parts
- Install Bottomside Components
- Wind and Install T1
- Install Topside Ics
- Install Remainder of Topside Components
- Download and Install Required Software
- Configure Si570 for LF Option
- Test the Stage

Local Oscillator and Control Detailed Build Notes

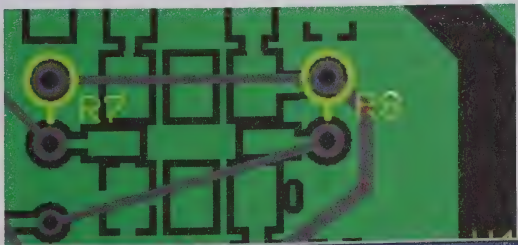
Bottom of the Board



BUILD

Install Protective Topside Parts

Install these resistors first, so as to protet against solder splashover at pins 4 and 8 off the Si570 (see below)



Check	Designation	Component	Marking	Category	Orientation	Notes
☐	R07	2.2k 1/6W 5%	red-red-red-gld	1/6W	N-S	
☐	R08	2.2k 1/6W 5%	red-red-red-gld	1/6W	N-S	

BUILD

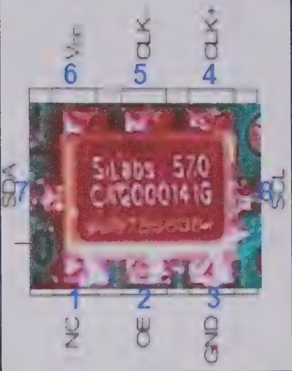
Install Bottomside Components

⚠ *Watch out when installing C35 to avoid solder splashover into the adjacent holes for the T1 primary windings.*

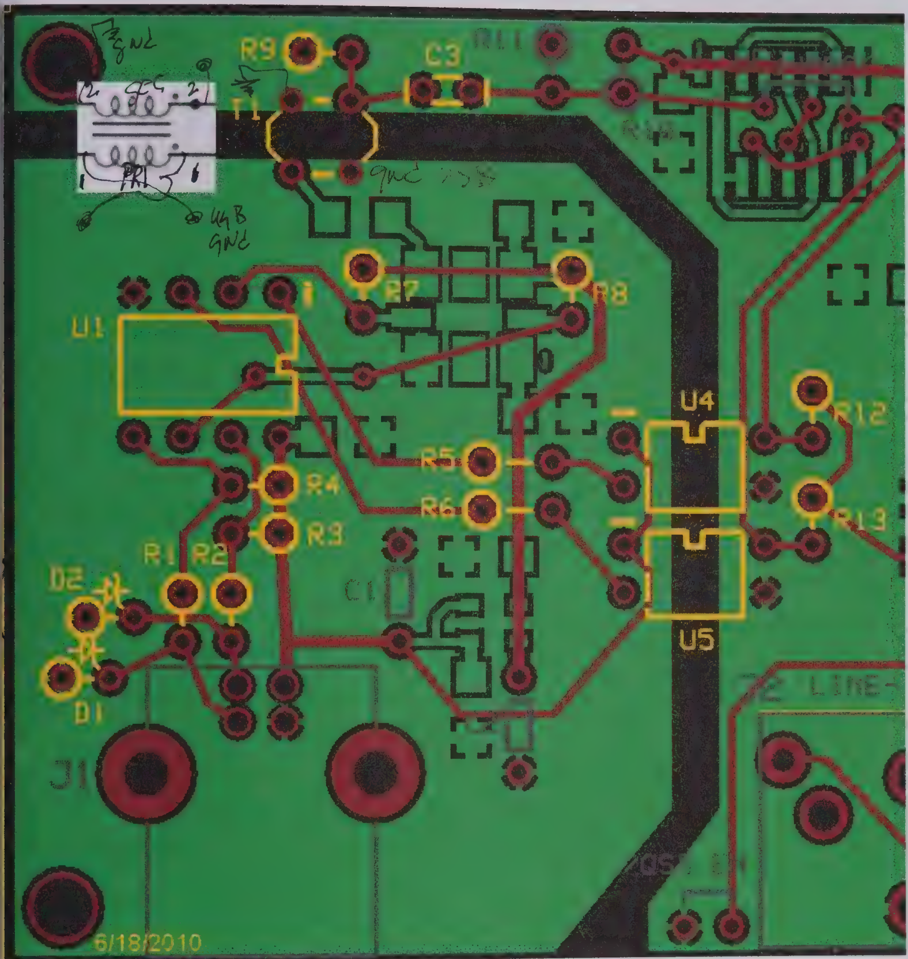
BUILD

Note the orientation photo for the Si570 and install with correct orientation.

Pay close attention to the pins 4 , 7, and 8, as their footprint is quite small relative to the other pads. The very tight space around those pins and the multiple contacts in close proximity can easily lead to frustrating solder bridges.

Check	Designation	Component	Marking	Category	Orientation	Notes
☐	U03	Si570 Programmable Oscillator	SiLabs 570  6 Vdd 5 CLK- 4 CLK+ SDA 7 8 SCL 1 NC 2 OE 3 GND SiLabs 570 CAX000141G	I2C		ESD
☐	C30	0.1 uF	(smt) black stripe	SMT 1206	white pads	
☐	C33	0.1 uF	(smt) black stripe	SMT 1206	white pads	
☐	C35	0.1 uF	(smt) black stripe	SMT 1206	white pads	

Top of the Board



BUILD

Wind and Install T1

You should take two 5" strands of #30 wire and twist them together ("bifilar") so you get around 3 twists to the inch. Using the resultant bifilar strand, thread it through the binocular core for two turns. Remember a turn is a trip that:

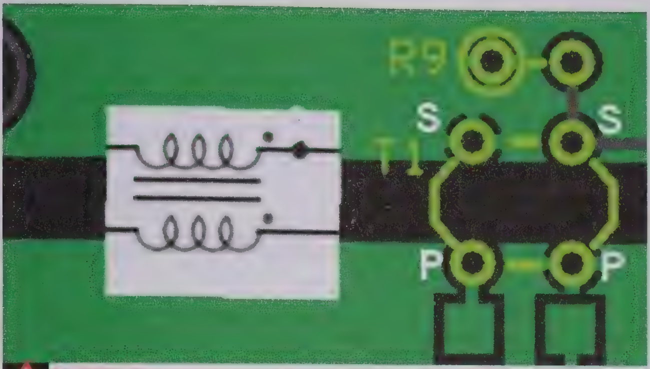
(1) starts at a particular hole
(2) goes into that hole and out of the other end
(3) goes into the hole nthat is across from the hole out of which it just exited, and
(4) Comes out of the hole at the opposite end and across from the original entry hole.

Do that series twice with the twisted pair and you have a transformer with two windings (each winding corresponding to one of the two twisted single wires).

Each winding (primary and secondary) is two turns. Since the windings are identical in length and number of turns, you can arbitratily pick either one as the primary, with the remaining winding serving as the secondary winding.

(Hint: use an ohmmeter (or other continuity checker) to identify which wire-ends go together to make the ends of a winding.

BUILD



⚠ *ALERT: The pcb layout for the Ensemble RX II has incorrect placement of the ground holes for the windings of T1, the local oscillator isolation transformer. This will be rectified in a later version of the pcb (as of 19 Juy 2012, the original version is documented herein).*
If the local oscillator isolation transformer is not connected properly some of the Si570 fundamental and harmonics will be radiated from the USB and other cables.
The principle is that the grounded side of the isolation transformers should go to the same end of the primary and secondary. The two wires that come from the same hole in the binocular core.
The fix for this is documented in a paper by Alan G4ZFQ - please refer to that paper for the important details.

pgs 1 thru 4 2/18/13

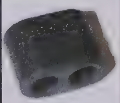
If you are unfamiliar with winding and installing inductors, you may want to refer to the WB5RVZ construction hints for coils (toroidal) and transformers (toroidal and binocular). Click here for details on identifying toroid cores.

Decoding the trqansformer specifications:

Transformers' windings are specified using the pattern "nnT/wXmmT" or "wXmmT/nnT", where:

- "nn" is the number of turns in the single winding
- "mm" is the number of turns in the multiple windings
- "w" = the number of multiple windings (e.g., 2 = bifilar; 3 = trifilar, etc.)

Thus, e.g., "18T/2x9T bifilar #30" means, using #30 wire, produce a single 18 turn primary winding and two 9-turn secondary windings; "2x9T bifilar/ 18T #30" means, using #30 wire, produce two 9-turn primary windings and a single 18 turn secondary winding.

<table>
<tr><th>Check</th><th>Designation</th><th>Component</th><th>Marking</th><th>Category</th><th>Orientation</th><th>Notes</th></tr>
<tr><td>☐</td><td>magwire</td><td>Magnetic Wire, enameled #30</td><td></td><td>Magnetic</td><td></td><td>(total of 30 ft. provided in kit)</td></tr>
<tr><td>☐</td><td>T01</td><td>band-specific</td><td><table><tr><th>Band</th><th>Component</th><th>Marking</th></tr><tr><td>HF</td><td>5.76uH: 2T(bi)T #30(8 (2x4)in) on BN43-2402</td><td></td></tr></table></td><td>misc</td><td></td><td>change from 3Ttrifilar</td></tr>
</table>

Softrock_Ensemble_Isolation_Transformers

This page has been checked by Tony, KB9YIG, the Softrock kit producer and supplier.

Gerhard PA1GVE discovered a mistake in the PCB layout of the Ensemble range. This is his post starting the thread. http://groups.yahoo.com/group/softrock40/message/66538

After much discussion the following has been determined.

If the local oscillator isolation transformer is not connected properly some of the Si570 fundamental and harmonics will be radiated from the USB and other cables.

If the antenna isolation transformer is not connected properly then the outer of the antenna coax will be prone to common mode currents causing noise pickup on receive and local emissions on transmit.

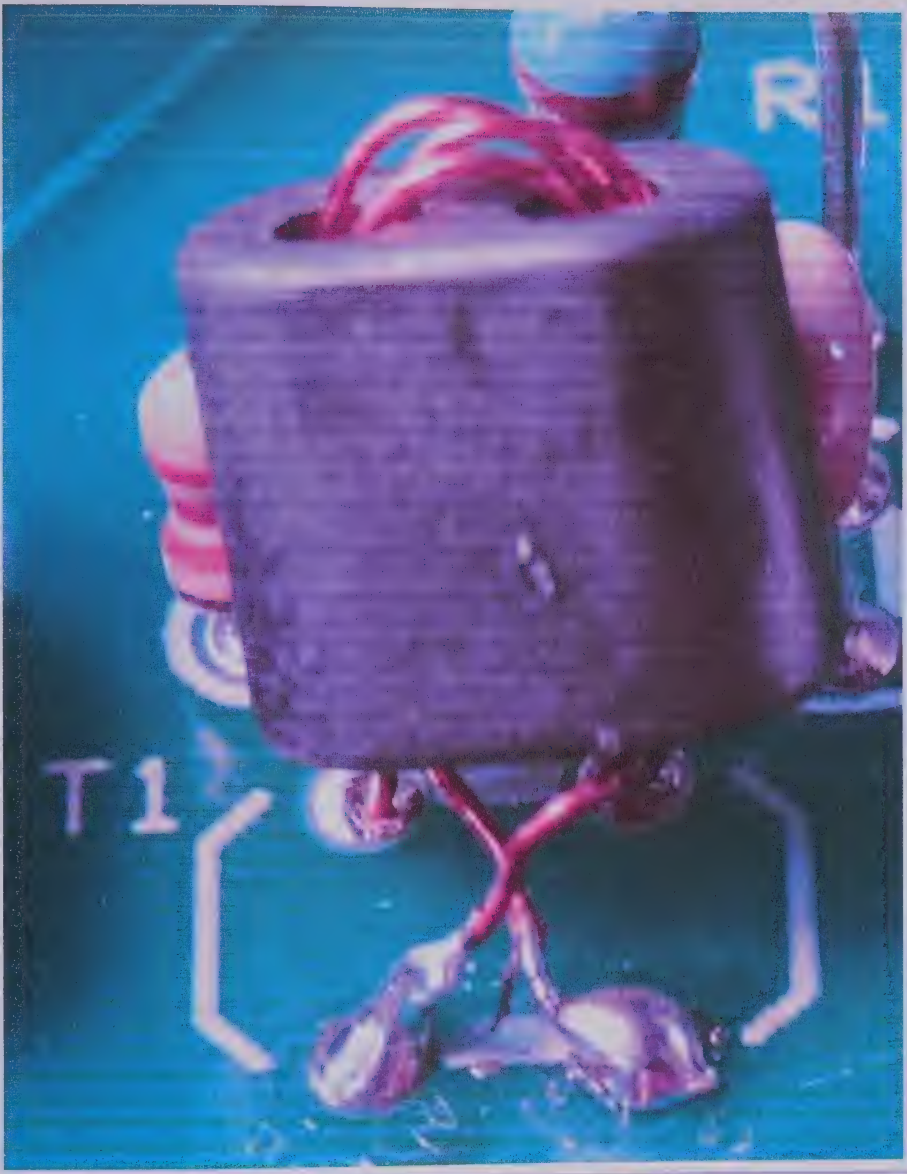
The principle is that the grounded side of the isolation transformers should go to the same end of the primary and secondary. The two wires that come from the same hole in the binocular core.

This only affects the Ensemble. In all cases the schematics are correct. **July 2012** Tony intends to alter the PCB when practical, at this time all Ensembles need altering. November 2012:- The VHF Ensemble is now correct, see below.

It is recommended that all Ensembles are modified.

Ensemble RX and Ensemble RXII:- T1 and T2 need one winding crossed.
Ensemble RXTX T6 needs one winding crossed.

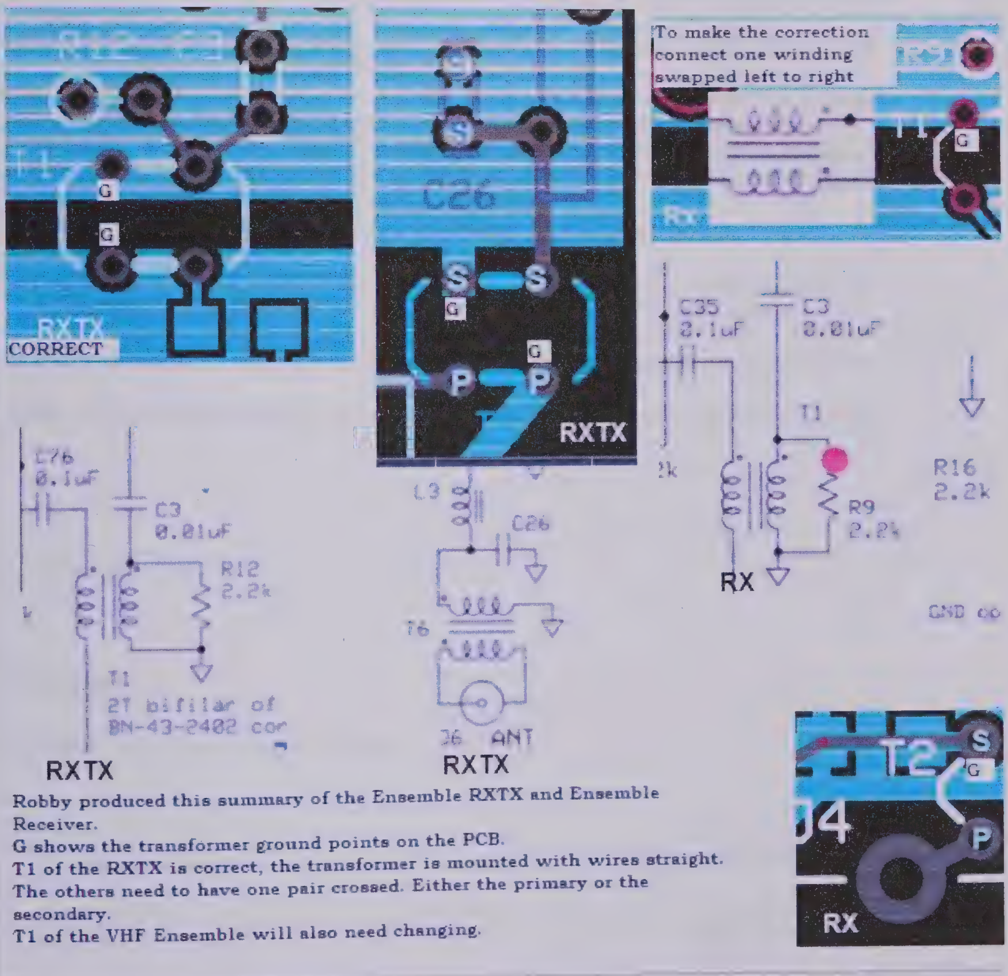
VHF Ensemble T1 needs one winding crossed. **November 12 2012**. "The board layout error on the 6m/4m/2m RX Ensemble board where either the primary or secondary leads of T1 needed to be crossed for best performance has now been corrected with the latest 6m/4m/2m RX Ensemble circuit board. The new circuit board, now supplied in 6m/4m/2m RX Ensemble kits, has the **date 9/8/12 in the silkscreen printing on the top surface of the board.**
Changes will be made to the RX Ensemble II board and RXTX Ensemble board when existing boards are used up.
Tony KB9YIG"



This shows a transformer with one winding crossed.
This was done on an installed transformer. After removing both wires (actually the primary) I soldered them from the top.
Either winding may be crossed.
So for an Ensemble that is already assembled the one that looks easiest to change may be altered.

Further Explanations.

Examination of the Ensemble receiver PCBs shows the grounding point of the two windings of the LO isolating transformer, T1, are diagonally apart, not adjacent. This also applies to the RXTX antenna transformer, T6.
On the Ensemble RX antenna input transformer, T2, the primary ground is the shell of the plug. The schematic shows the secondary is grounded to RF by C37. So one of the windings needs to be fitted crossed.
The RXTX LO transformer,T1, is correct.



To make the correction connect one winding swapped left to right

Robby produced this summary of the Ensemble RXTX and Ensemble Receiver.
G shows the transformer ground points on the PCB.
T1 of the RXTX is correct, the transformer is mounted with wires straight.
The others need to have one pair crossed. Either the primary or the secondary.
T1 of the VHF Ensemble will also need changing.

Note the "ANT GND" option should normally be left disconnected. A link here defeats the purpose of using an isolating transformer.

LOW OUTPUT ON 20 METRES WITH AN ENSEMBLE RXTX BUILT FOR

40/30/20m

Paul, 9H1FQ, persevered with this problem that has affected some of the Ensembles built to this configuration and found the LPF to blame.
Tony has altered the design slightly. It was found the HF cutoff was too low. See Robby's pages http://www.wb5rvz.org/ensemble_rxtx/ and set the band option.
The revision is on RF/IO.

My tests seem to put the blame on the T37-6 cores, I measured an AL_Value of 3.8 compared with the 3.0 specified.
The original design seems correct but the tolerance of the core material has caused the inductors to be too high. I measured 1uH rather than the specified 0.8uH.
To correct for this on assembled Ensembles I suggest just reducing the number of turns on L2 and L3. Try removing one or two turns and check that one watt output is easily achieved on 20m.
This should make the LPF conform to the original design.

I am wondering if this might affect other LPFs. If the 30/20/17 metre build has a significantly lower output on 17m try removing a turn from L2 and L3.

Note that the available output is greatest on the low frequencies and reduces on the higher bands.
A 160m Ensemble may well give over 2 watts but a 10m Ensemble may struggle to make 1 watt.

http://sites.google.com/site/g4zfqradio/home

Comments

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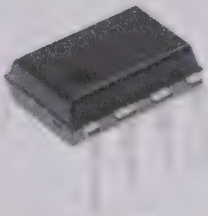
				(xfrmr)				
			LF	12.96uH: 3T(bi)T #30(10 (2x5)in) on BN43-2402 (xfrmr)				

Install Topside Ics

Double check the orientation on the two optoisolators. They should be oriented so that their "dimple" is in the upper left-hand corner.

Check	Designation	Component	Marking	Category	Orientation	Notes
☐	SO1	8 pin dip socket		Socket		for ATTiny85
☐	U01	ATtiny 85-20 PU w/V15.12 Firmware	AVR ATTINY85-20PU 	DIP 8	(dimple in upper right)	Take ESD precautions
☐	U04	LTV-817 Opto-Isolator	LTV 817	DIP-4	(dimple in upper left)	Take ESD precautions
☐	U05	LTV-817 Opto-Isolator	LTV 817	DIP-4	(dimple in upper left)	Take ESD precautions

Install Remainder of Topside Components

Careful installing the resistors and diodes clustered near the USB connector area. Builders have been known to insert these into the wrong holes. Review the board layout and the orientation column below to double check the orientation.

The body of each zener is to be located above the silkscreen circles for D1 and D2 on the board with the diodes mounted standing perpendicular to the board in a hairpin fashion. The banded end of each diode is then at the lead of the diode that loops back to the circuit board.

Check	Designation	Component	Marking	Category	Orientation	Notes
☐	D1	BZX55C3V3 3.3V zener diode	BZX55C	Axial		The band end of the diode is the hairpin lead - see board layout

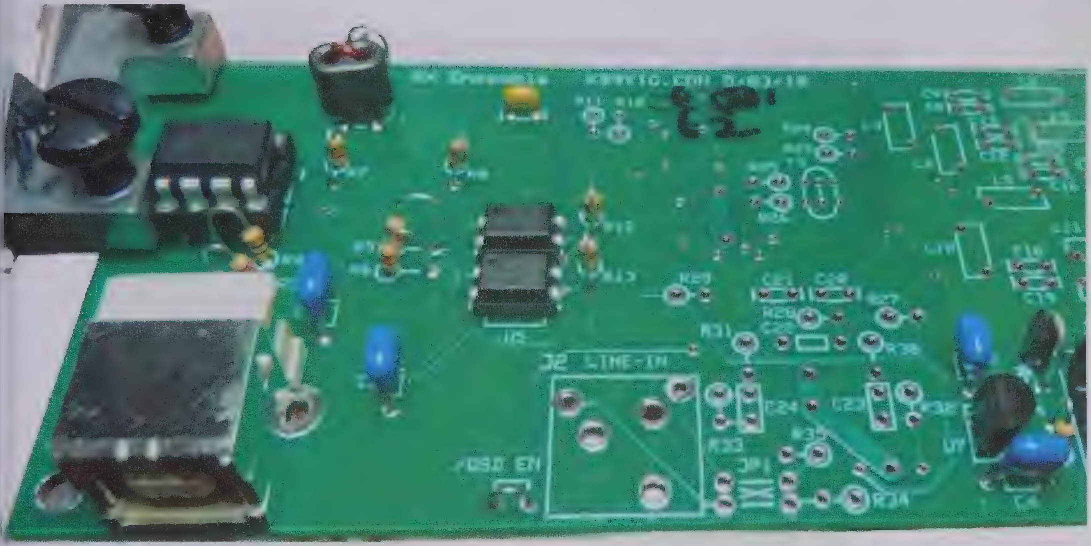
☐	D2	BZX55C3V3 3.3V zener diode	BZX55C	Axial	orientation	The band end of the diode is the hairpin lead - see board layout
☐	C03	0.01 uF	103	Ceramic	horiz	
☐	R01	68 1/6W 5%	bl-gry-blk-gld	1/6W	N-S	
☐	R02	68 1/6W 5%	bl-gry-blk-gld	1/6W	N-S	
☐	R03	2.2k 1/6W 5%	red-red-red-gld	1/6W	E-W	
☐	R05	2.2k 1/6W 5%	red-red-red-gld	1/6W	W-E	
☐	R06	2.2k 1/6W 5%	red-red-red-gld	1/6W	W-E	
☐	R09	2.2k 1/6W 5%	red-red-red-gld	1/6W	W-E	chenged from 221
☐	R12	10 k 1/6W 5%	brn-blk-ora-gld	1/6W	N-S	
☐	R13	10 k 1/6W 5%	brn-blk-ora-gld	1/6W	N-S	
☐	R04	1 M 1/6W 5%	brn-blk-grn-gld	1/6W	E-W	

Download and Install Required Software

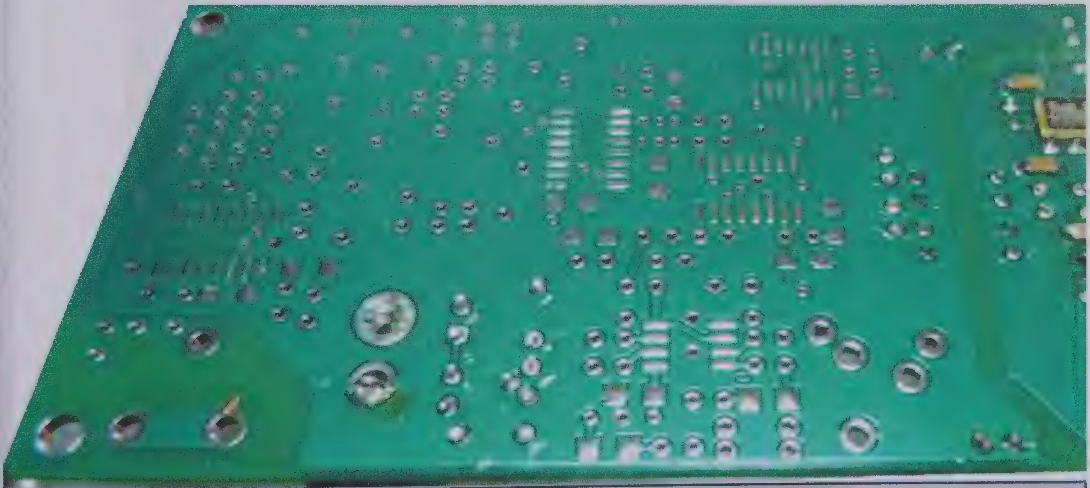
All of the latest versions of essential firmware configuration programs, USB driver and their associated documentation can be obtained from Fred PE0FKO's website:

- USB driver: (search for "Download Firmware source and .hex files")
- CFGSR program: (search for "Download")
- Documentation

In order to test (and later, operate) your rig, you must download and install required software (SDR programs and Dynamic Link Libraries, along with hardware drivers. The actual steps and programs may vary, depending upon your computer's windows operating system version (XP, Vista, or Windows 7) and architecture CPU/memory (32 bit or 64 bit).



Bottom of the Board



Local Oscillator and Control Testing

Current Draw

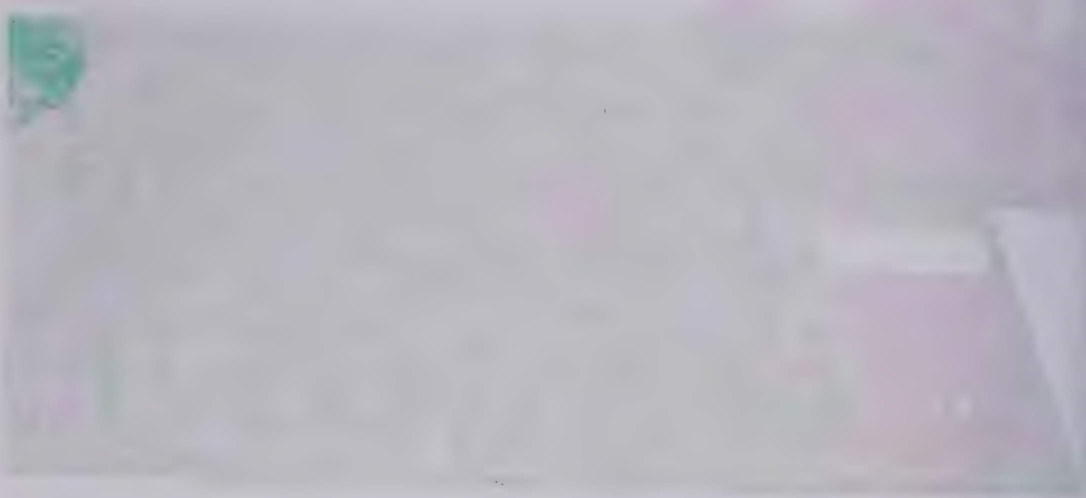
Test Setup

Power up the regular circuit side of the board

Measure the current draw on the 12 V power lead (WITHOUT the USB plugged in)

Plug in the USB cable and keep 12V power to the main circuit

Measure the current draw on the 12 V power lead (WITH the USB plugged in). You should get a slightly higher current draw.



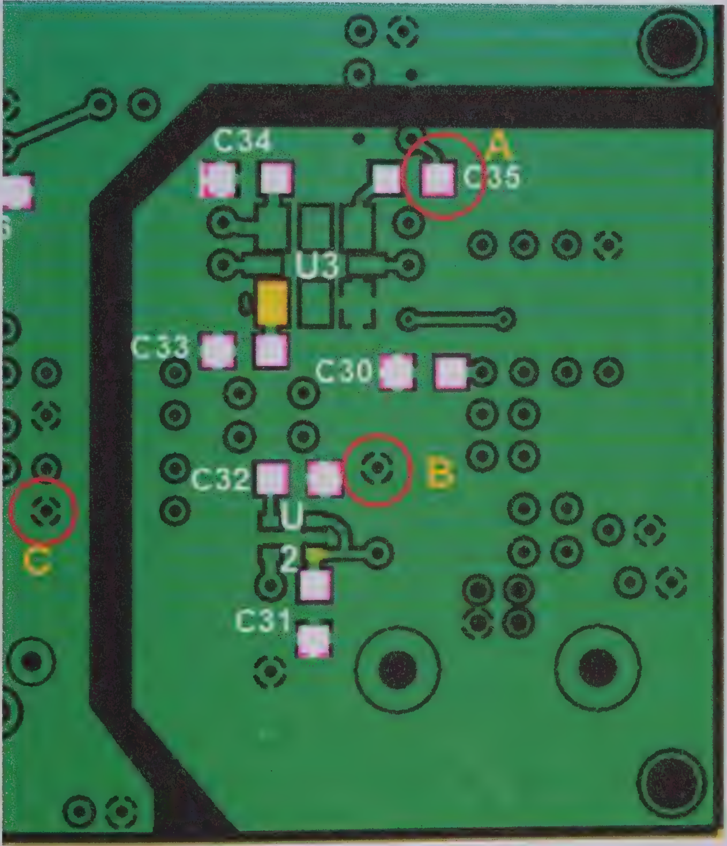
Test Measurements

Testpoint	Units	Nominal Value	Author's	Yours
Current Draw - NO USB	mA	< 8	4.3	
Current Draw - USB plugged in	mA	< 9	5.3	

Test T1 Windings

Test Setup

Using an ohmmeter, check for continuity between the right-hand pad for C35 (point marked "A") and the USB ground (point marked "B"). You should get continuity (~ 0 ohms). Then, check for continuity (~ 0 ohms) between the right-hand pad of C35 (point marked "A") and the regular ground (point marked "C"). You should NOT get continuity; if you do get continuity, then you have a short in the windings or you have your windings crossed.



Test Measurements

Testpoint	Units	Nominal Value	Author's	Yours
"A" to "B"	ohms	~0		
"A" to "C"	ohms	~ infinity		

LO Stage Outputs

Test Setup

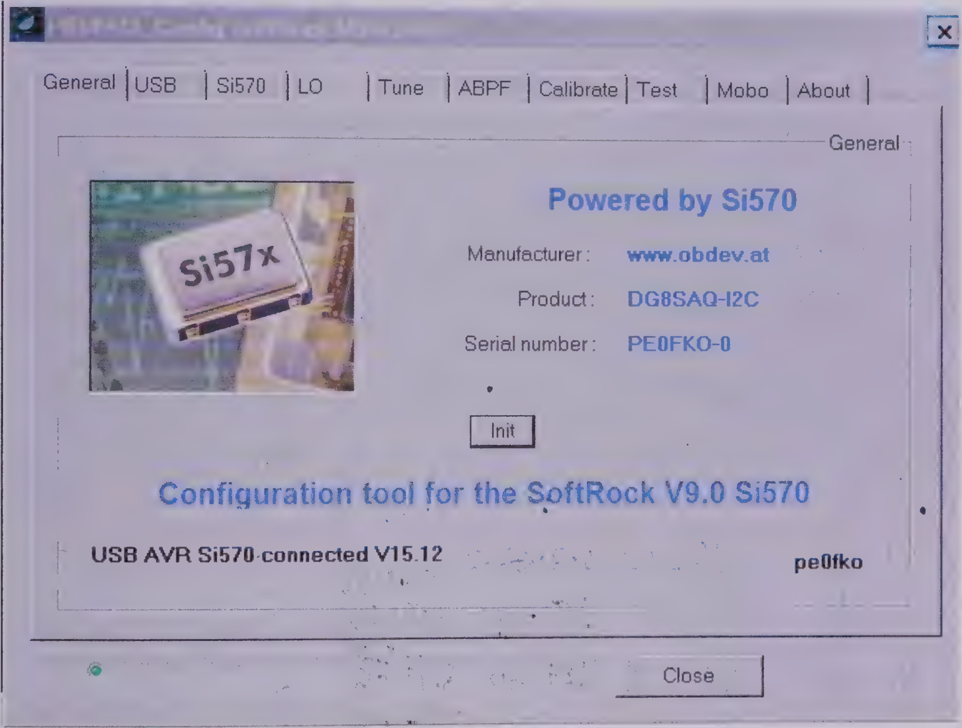
Here we want to measure the output (4x center frequency for dividers). It is measured WRT (regular)

ground (at the R9 hairpion lead).

Setup

Be sure all software and drivers, etc., have been installed. Connect the USB jack via USB cable to the PC. You should hear the "BoopBoop" sound the PC makes when it recognizes a device (the Ensemble) has been attached to a USB port..

Next, run CFGSR.exe and you should get the following screen:



Powered by Si570

Manufacturer : www.obdev.at

Product : DG8SAQ-I2C

Serial number : PE0FKO-0

Configuration tool for the SoftRock V9.0 Si570

USB AVR Si570 connected V15.12

pe0fko

Then, check out the "Si570" tab. It should look like this:

HF settings

LO, tab

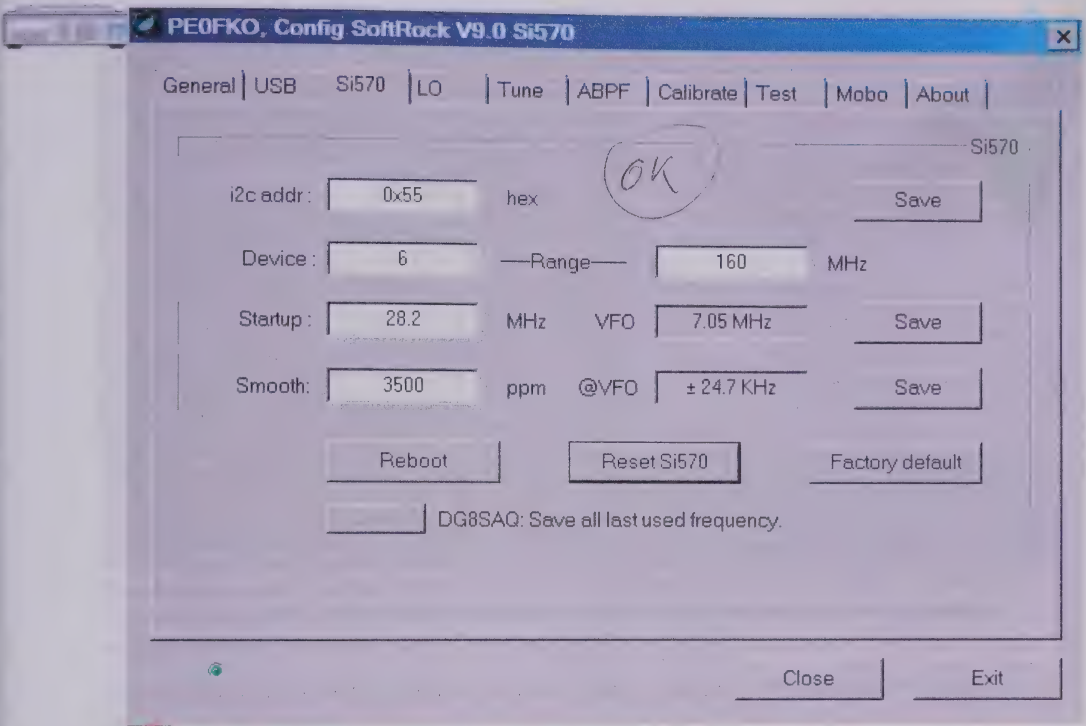
	(HF)	(LF)
mult	$\boxed{4}$	$\boxed{16}$
	$\boxed{0}$	$\boxed{0}$
		$\boxed{4}$
mult	$\boxed{4}$	
	$\boxed{0}$	$\boxed{0}$
mult	$\boxed{1}$	$\boxed{4}$
	$\boxed{0}$	$\boxed{0}$

ABPF

(HF)	(x4)	(LF)	(x4)	Filter	
0-4	4-16	0-.398	0-1.59	⓪	0
4 8	16-32	0.398-.797	1.59-3.19		1
8-16	32-64	.797-1.59	~~1.59~~ 3.19		2
16-∞	64-∞	1.59 ∞	3.19-6.38		
			6.38-∞		3

INT

☐ EnsembleRX LF/HF(HP)



OK

i2c addr: 0x55 hex

Device: 6 —Range— 160 MHz

Startup: 28.2 MHz VFO 7.05 MHz

Smooth: 3500 ppm @VFO ± 24.7 KHz

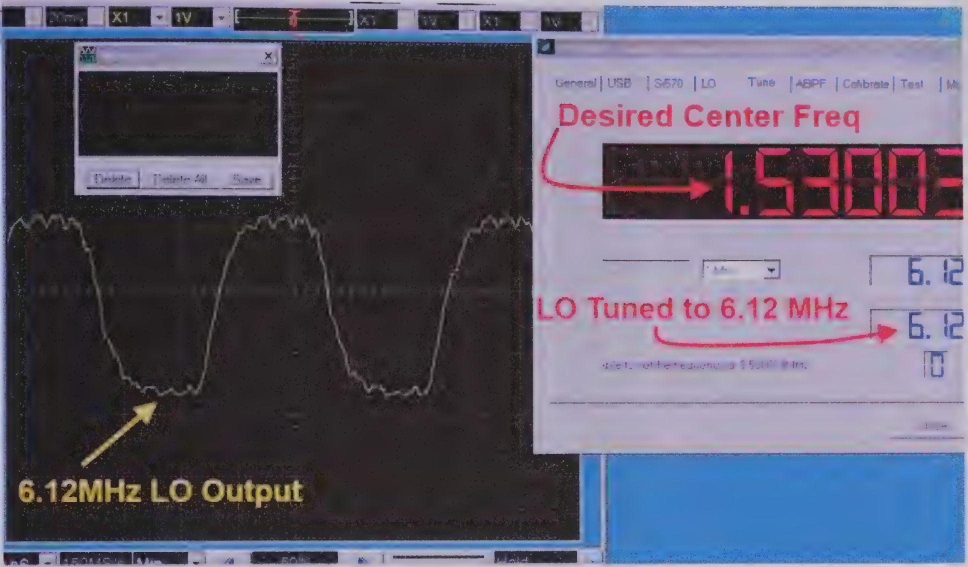
☐ DG8SAQ: Save all last used frequency.

Note that the Local Oscillator's outputs are measured with respect to the analog ground plane, NOT with respect to the galvanically isolated USB groundplane. The /QSD EN shunt is a good point for this ground connection.

Using the CFGSR Software (at the "Tune" tab), test scenarios for setting the center frequency (remember, the Si570 produces a signal that is 4 times the desired center frequency).

Measure the output at the hairpin lead of R9.

Below is an example of tuning the Si570 in CFGSR, selecting a center frerquency of 1.53 MHz (with an Si570 output frequency of 4x, or 6.12MHz. (Pay no attention to the lousy oscilloscope behind the curtains - the output is really a square wave, but the scope is a cheap USB scope that doesn't sample HF square waves very well.)



You can place your mouse on the frequency in the center frequency field and turn your mouse wheel. The center frequency will increase or decrease and the LO Output frequency (4x) will increase or decrease at a rate 4 times that of the center frequency.

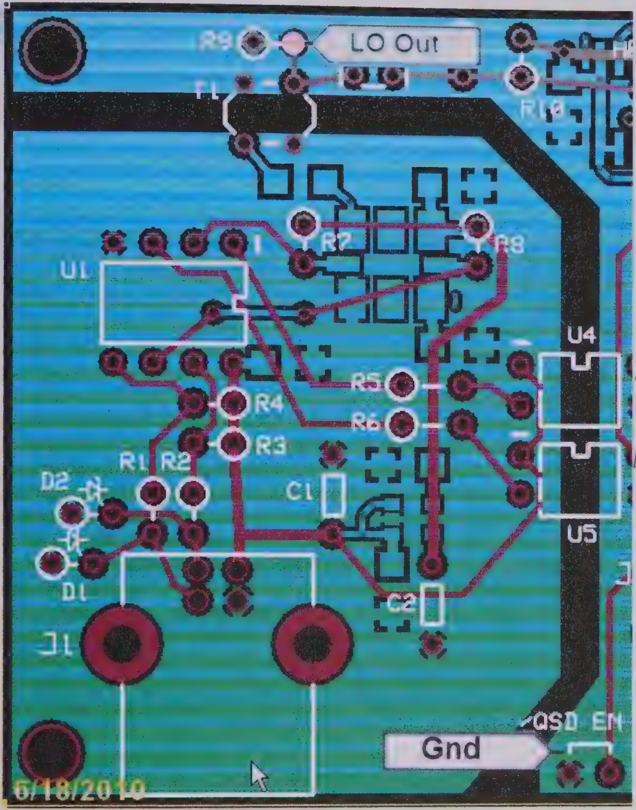
John, KB6QL, discovered this trick for those with no scope, counter, or HF radio to use in testing LO output:

"Turns out that local oscillator can be tuned for a frequency that is in the FM band. So, as a quick and dirty, I got out my little MP3 player-cum-FM-radio and tuned it to that frequency and let the headset cord/ant drape over the RX. It gave me full quieting. Then I switched the RX to another frequency and the quieting was gone."

Troubleshooting Hints

Si570 Does Not Respond to Control Signals

Soldering on the Si570 is the most usual problem with lack of control, providing the USB is properly recognised.



Band	0	1	2	3
R12	0	0	5	5
R13	0	5	0	5

Validate Filter Selection Outputs

Test Setup

Start up CFSR again and tune the local oscillator through four frequencies (each being in the middle of one of the bands):

1. 2MHz
2. 6MHz
3. 12MHz
4. 24MHz

Measure the voltages at "FL SEL 0" (R13 hairpin) and "FL SEL 1" (R12 hairpin) with respect to regular ground

(The high/low values at R12 and R13 are used in the ABPF switching truth table, shown in the Automatic Band Pass Filter stage's introductory paragraphs.

Test Measurements

Testpoint	Units	Nominal Value	Author's	Yours
R12 (for 2 MHz band 0)	Vdc	0	100 mV	
R12 (for 6 MHz band 1)	Vdc	0	100 mV	

R12 (for 12 MHz band 2)	Vdc	5	4.92	
R12 (for 24 MHz band 3)	Vdc	5	4.92	
R13 (for 2 MHz band 0)	Vdc	0	100 mV	
R13 (for 6 MHz band 1)	Vdc	5	4.92	
R13 (for 12 MHz band 2)	Vdc	0	100 mV	
R13 (for 24 MHz band 3)	Vdc	5	4.92	

Ensemble RX II 04_Quadrature Clock Generator

Home Bill of Materials Power Supply USB Power Supply Local Oscillator and Control Quadrature Clock Generator Auto Band Pass Filters Quadrature Sampling Detector Operational Amplifiers Comments Acronyms Inventory Revisions as of 7/19/2012 Components By Stage WB5RVZ Main Website

Search: Search selected SDR sites

Quadrature Clock Generator Introduction

General

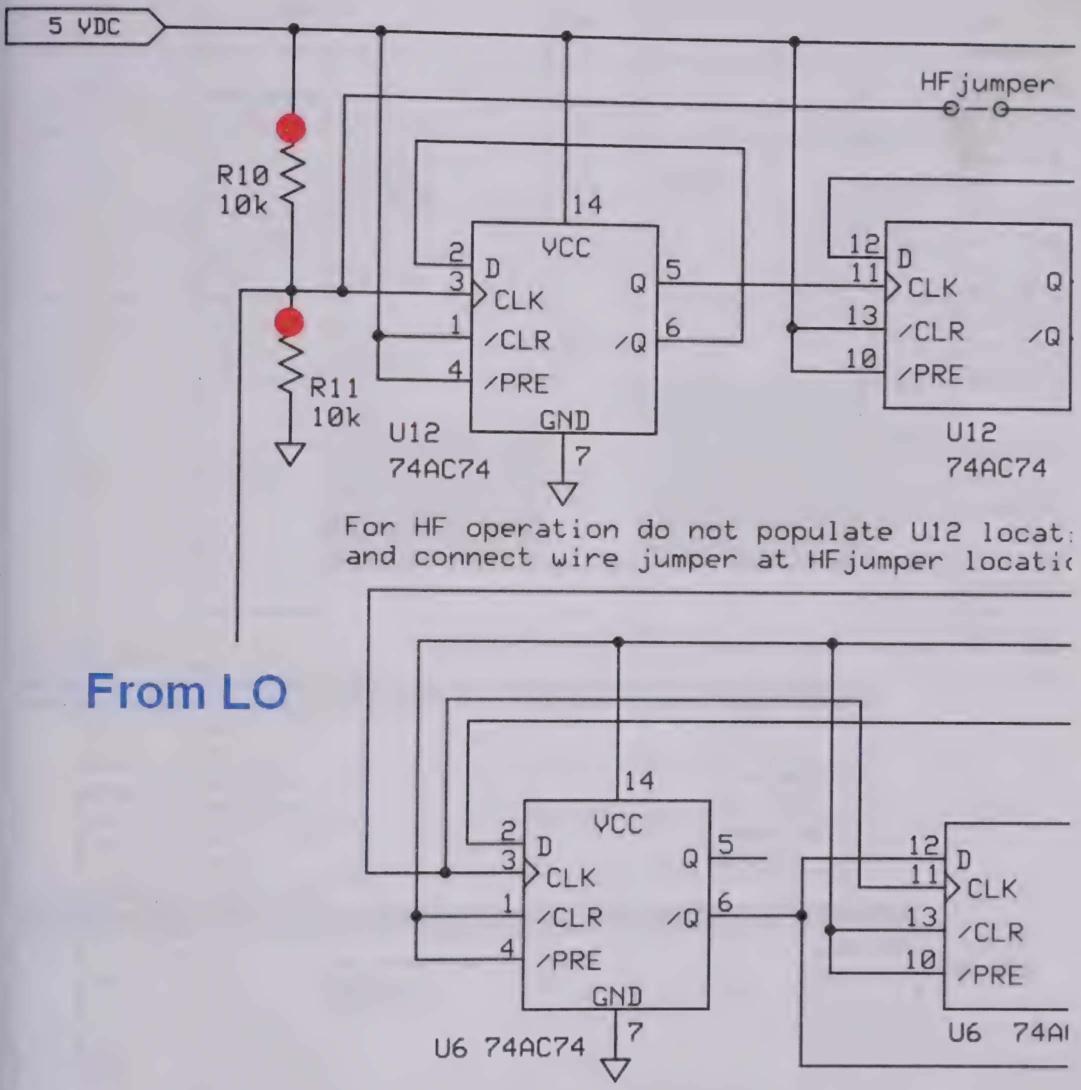
This stage divides the local oscillator output by 4 and shifts the phase of the dividend signals such that they are now one-fourth the LO frequency and 90 degrees separated in phase (i.e., in quadrature). Both signals are identical in all regards except phase. They will be used to clock the switch used in the Quadrature Sampling Detector (QSD) stage.

(go directly to build notes)

Quadrature Clock Generator Schematic

(Resistor testpoints (hairpin, top, or left-hand lead), as physically installed on the board, are marked in the schematic with red dots)

(Click for Full Schematic)



For HF operation do not populate U12 locat
and connect wire jumper at HF jumper locati

(above schematic has clickable areas that can be used for navigation)

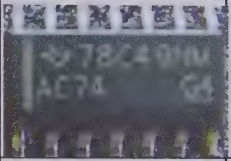
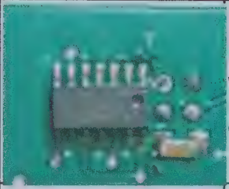
(go directly to build notes)

Quadrature Clock Generator Bill of Materials

Stage Bill of Materials

(resistor images and color codes courtesy of Wilfried, DL5SWB's R-Color Code program)

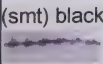
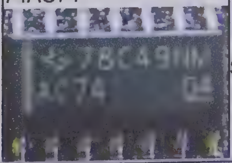
Check	Designation	Component	Marking	Category	Orientation	Notes	Circuit

☐	C48	band-specific		misc			Quadrature Clock Generator
☐	hf-jmp	band-specific		misc			Quadrature Clock Generator
☐	C36	0.1 uF	(smt) black stripe	SMT 1206	yellow pads		Quadrature Clock Generator
☐	R10	10 k 1/6W 5%	brn-blk-ora-gld	1/6W	S-N		Quadrature Clock Generator
☐	R11	10 k 1/6W 5%	brn-blk-ora-gld	1/6W	N-S		Quadrature Clock Generator
☐	U06	74AC74 Dual D FF	74AC74 	SOIC-14		Markings vary - look for "AC74"	Quadrature Clock Generator
☐	U12	band-specific		misc			Quadrature Clock Generator

Band Specific Items for HF Band

Check	Designation	Component	Marking	Category	Orientation	Notes	Circuit
☐	C48	omit for this band		Omit			Quadrature Clock Generator
☐	hf-jmp	shunt wire (cut-off lead)		Cutoff			Quadrature Clock Generator
☐	U12	omit for this band		Omit			Quadrature Clock Generator

Band Specific Items for LF Band

Check	Designation	Component	Marking	Category	Orientation	Notes	Circuit
☐	C48	0.1 uF	(smt) black stripe 	SMT 1206			Quadrature Clock Generator
☐	hf-jmp	omit for this band		Omit			Quadrature Clock Generator
☐	U12	74AC74 Dual D FF	74AC74 	SOIC-14			Quadrature Clock Generator

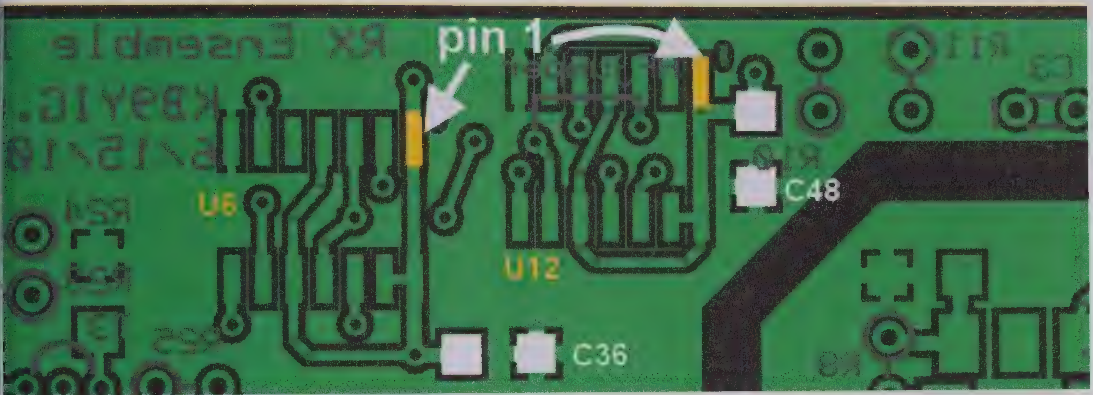
Quadrature Clock Generator Summary Build Notes

- Install Voltage Divider Resistors

- Install ICs and SMT Capacitors
- Install HF Jumper
- Test the Stage

Quadrature Clock Generator Detailed Build Notes

Bottom of the Board

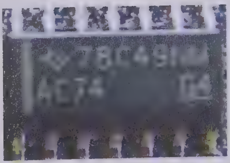
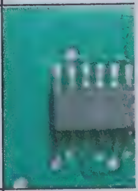


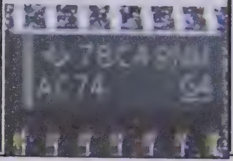
BUILD

Install ICs and SMT Capacitors

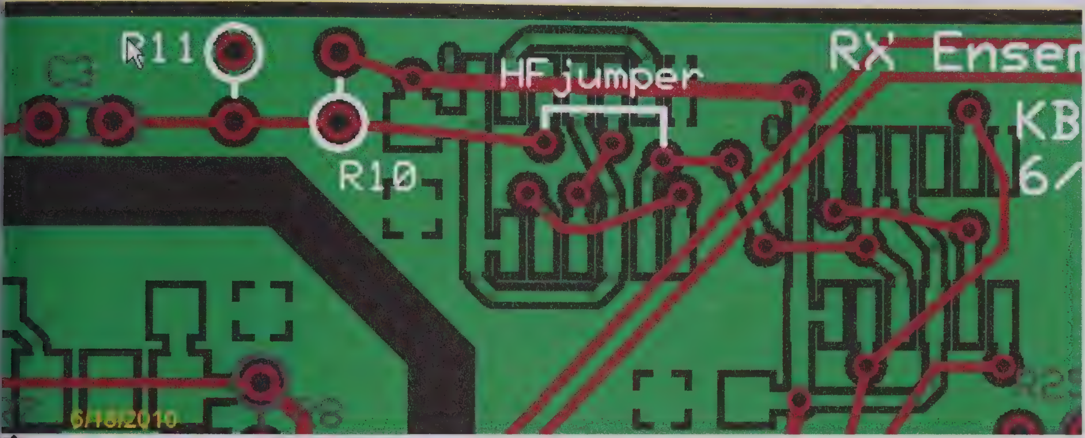
Here, you will install U6 (to get a divide-by-4) and, if building the LF option, U12 (to get a divide-by-16); also installed will be the appropriate SMT bypass capacitors.

U6 is required for both HF and LF options; U12 is only needed for the LF option. Watch out for the potential to install U6 in the wrong set of pads!

<table>
<tr><th>Check</th><th>Designation</th><th>Component</th><th>Marking</th><th>Category</th><th>Orientation</th></tr>
<tr><td>☐</td><td>C48</td><td>band-specific</td><td><table><tr><th>Band</th><th>Component</th><th>Marking</th></tr><tr><td>HF</td><td>omit for this band (Omit)</td><td></td></tr><tr><td>LF</td><td>0.1 uF (SMT 1206)</td><td>(smt) black stripe </td></tr></table></td><td>misc</td><td></td></tr>
<tr><td>☐</td><td>C36</td><td>0.1 uF</td><td>(smt) black stripe </td><td>SMT 1206</td><td>yellow pads</td></tr>
<tr><td>☐</td><td>U06</td><td>74AC74 Dual D FF</td><td>74AC74 </td><td>SOIC-14</td><td></td></tr>
<tr><td>☐</td><td>U12</td><td>band-specific</td><td><table><tr><th>Band</th><th>Component</th><th>Marking</th></tr><tr><td>HF</td><td>omit for this band (Omit)</td><td></td></tr></table></td><td>misc</td><td></td></tr>
</table>

			LF	74AC74 Dual D FF (SOIC-14)	74AC74 		

Top of the Board



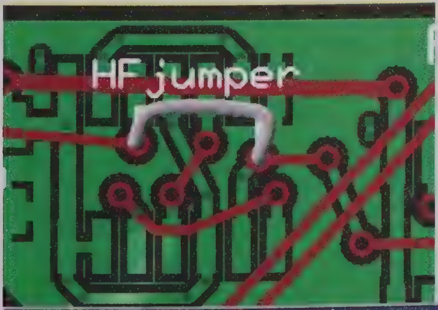
Install Voltage Divider Resistors

Pay careful attention to the orientation (S-N and N-S, respectively) of R10 and R11. Some builders have inadvertently installed these with a horizontal orientation rather than a vertical orientation.

Check	Designation	Component	Marking	Category	Orientation	Notes
☐	R10	10 k 1/6W 5%	brn-blk-ora-gld	1/6W	S-N	
☐	R11	10 k 1/6W 5%	brn-blk-ora-gld	1/6W	N-S	

Install HF Jumper

If building the HF option, omit U12 and Install the jumper wire to bypass U12 with the LO signal



Check	Designation	Component	Marking	Category	Orientation	Notes

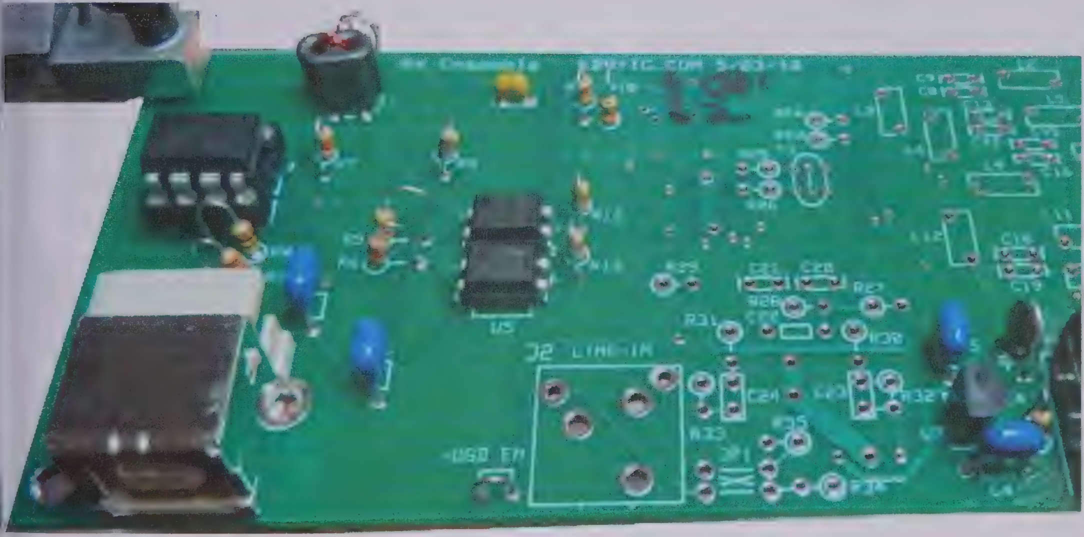
BUILD

<table>
<tr><td>☐</td><td>hf-jmp</td><td>band-specific</td><td><table><tr><th>Band</th><th>Component</th><th>Marking</th></tr><tr><td>HF</td><td>shunt wire (cut-off lead) (Cutoff)</td><td></td></tr><tr><td>LF</td><td>omit for this band (Omit)</td><td></td></tr></table></td><td>misc</td><td></td><td></td></tr>
</table>

Quadrature Clock Generator Completed Stage

(These photos were of an earlier board design. It has changed since the author built the kit upon which these notes are based. The board layout graphics are, however, current.)

Top of the Board



Bottom of the Board

Quadrature Clock Generator Testing

Current Draw

Test Setup

With both the USB cable and the power cable plugged in, measure the current draw in the positive power lead.

Measure the current draw with just the 12V power.

Note: the current draw will be slightly higher if you installed U12 as part of an LF option build

Test Measurements

Testpoint	Units	Nominal Value	Author's	Yours
Current draw WITH USB	mA	< 18	9.8	______
Current draw NO USB	mA	< 20	13.7	______

Test Voltage Divider

Test Setup

When performing the following tests, you must apply [pwer to the board AND plug in the USB cable. Otherwise, results will not be as expected.

Plug in USB and power the board.

Measure the voltage on the R11 hairpin; you should see 50% of the %v rail voltage.

Depending upon your DMM, your measurements may vary. What we are looking for here is roughly half the 5 volt rail

Test Measurements

Testpoint	Units	Nominal Value	Author's	Yours
R11 hairpin (WRT regular gnd)	V dc	2.5	2.46	

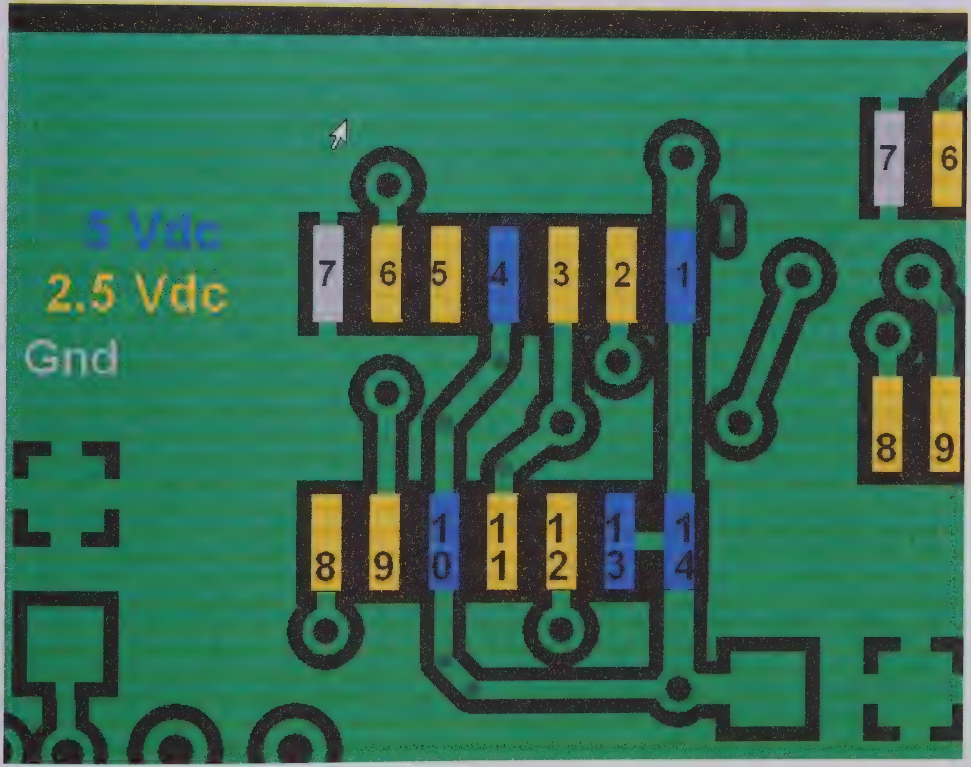
Divider Pin Voltages

Test Setup

Power USB and 12V. Then measure the voltages on the pins (and, separately, on the pads) of U6 (74AC74). Refer to the color codes on the graphic for the voltages.

Pins 3 and 11 will not show exactly 2.5Vdc because they have the additional AC component of the local oscillator signal from C3. The important idea is - for those pins which should nominally be 2.5Vdc - you do NOT want to see 0 or 5 Vdc!

If you are building the LF option, you should perform this test on both U12 and U6; otherwise, just test U6.



Test Measurements

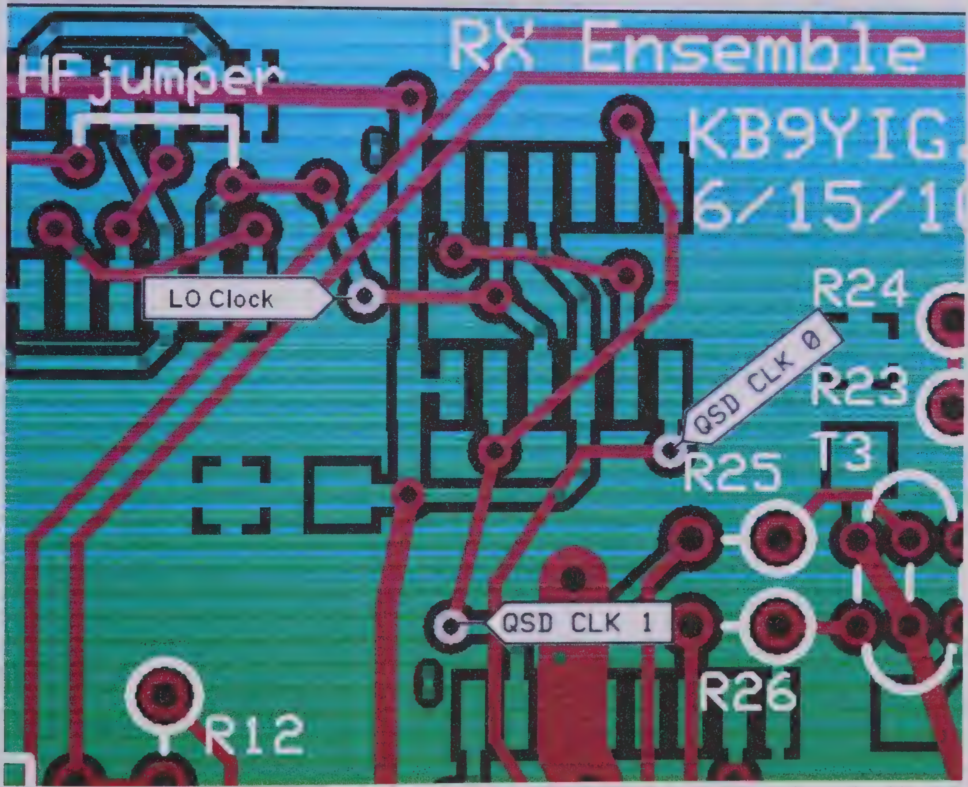
Testpoint	Units	Nominal Value	Author's	Yours
Pin 1	Vdc	5	4.92	
Pin 2	Vdc	2.5	2.45	
Pin 3	Vdc	2 to 3	2.46	
Pin 4	Vdc	5	4.92	
Pin 5	Vdc	2.5	2.45	
Pin 6	Vdc	2.5	2.45	

Pin 7	Vdc	0 (GND)	0	
Pin 8	Vdc	2.5	2.45	
Pin 9	Vdc	2.5	2.45	
Pin 10	Vdc	5	4.92	
Pin 11	Vdc	2.5	2.46	
Pin 12	Vdc	2 - 3	2.45	
Pin 13	Vdc	5	4.92	
Pin 14	Vdc	5	4.92	

Quadrature Colck Generated Waveforms

Test Setup

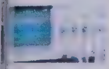
Set your board up to oscillate at a selected center frequency, e.g., 7.100 MHz.

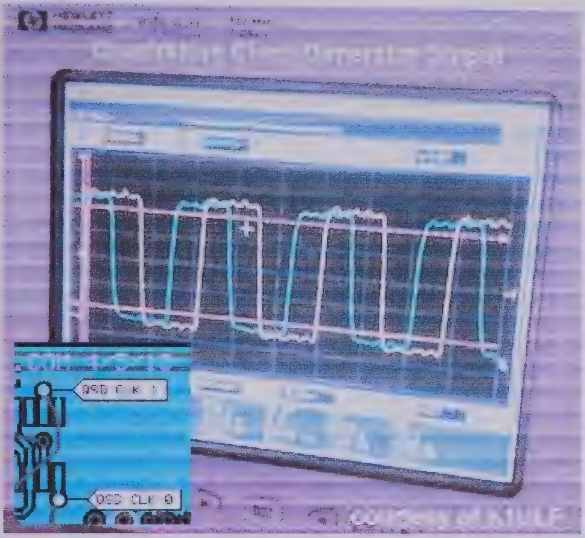


If you have a dual trace scope available, probe the two "QSD CLK (n)" test points and you should get a waveform similar to the one shown here.

The testpoint marked "LO Clock" will provide the Si570's output frequency or, in the case of the LF option, that frequency divided by 4 (courtesy of U12).

Your mileage may vary, depending upon the desired center frequency you select and the quality of your scope (some scopes tend to have issues with these square waves - still, the scope should show two waveforms in quadrature at the desired center frequency).




Quadrature Clock Generator Output
QSD CLK 1
QSD CLK 0

LATEST

WB5RVZ.Org - Ensemble HF/LF RX II

Ensemble RX II (HF/LF) Quadrature Clock Generator
Band: HF

Introduction

Band Specific Components

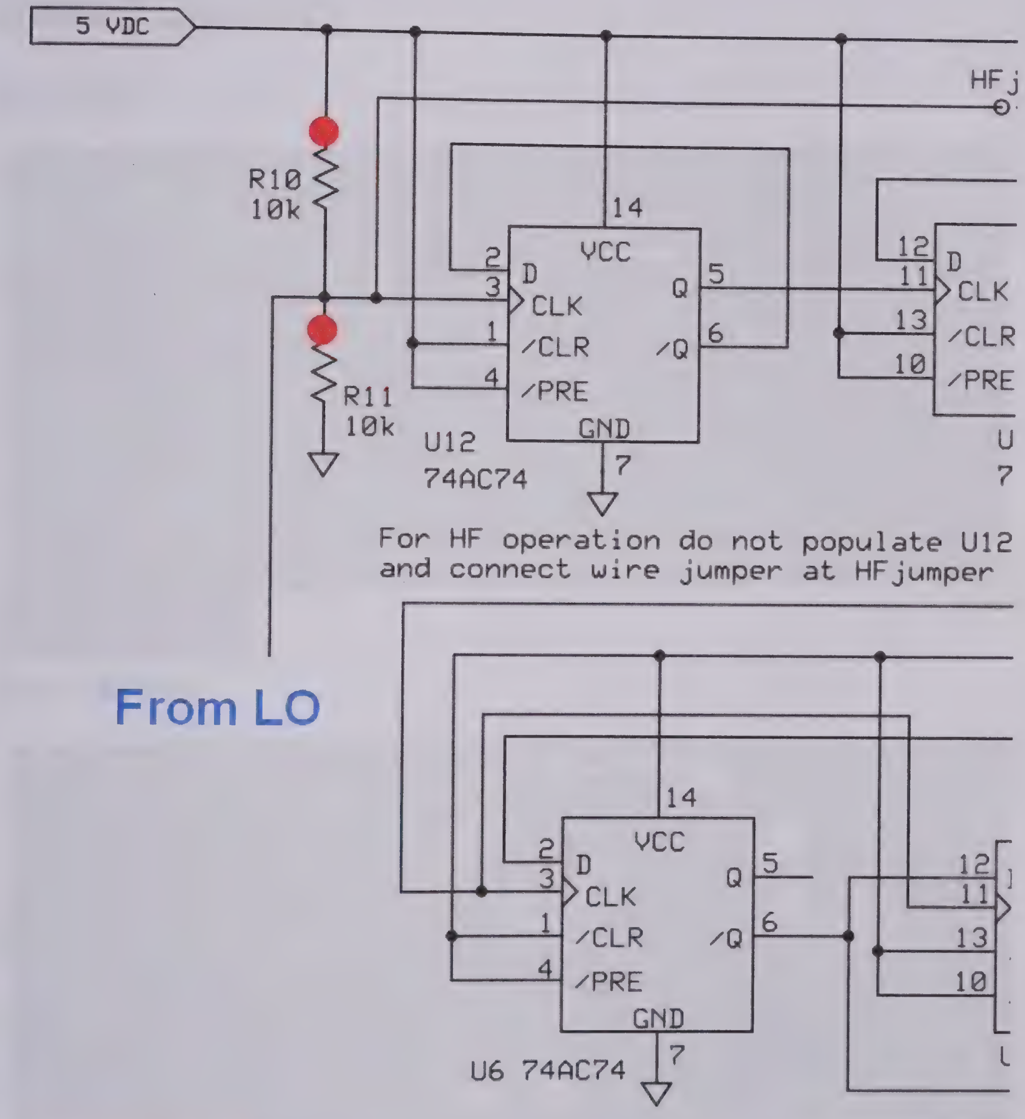
This stage involves band-specific components and is currently configured for the HF band. If you need to configure this page for a different band, click on the "Band" tab in the menu above. This would take you to the home page, where you can select the new band and then return to this page.

General Info About the Stage

This stage divides the local oscillator output by 4 and shifts the phase of the dividend signals such that they are now one-fourth the LO frequency and 90 degrees separated in phase (i.e., in quadrature). Both signals are identical in all regards except phase. They will be used to clock the switch used in the Quadrature Sampling Detector (QSD) stage.

Theory of Operation

Stage Schematic



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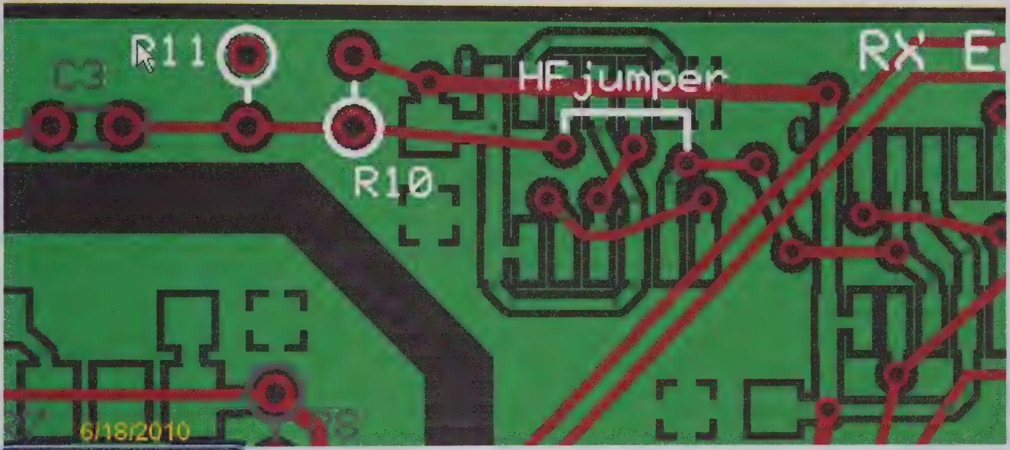
Click here for full schematic

(Red dots represent the "hairpin" (or left-hand or topmost) lead of the

component)

Board Layouts

Board Top



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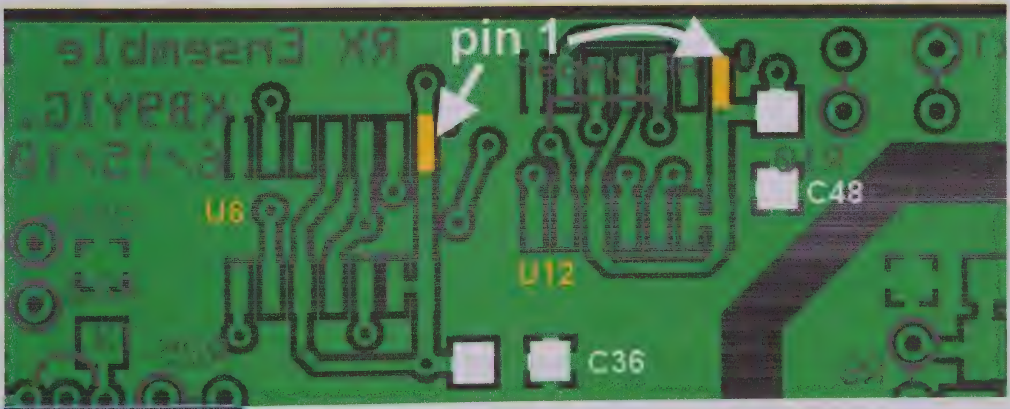
Board Bottom



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Summary Build Notes

1. Install Voltage Divider Resistors
2. Install ICs and SMT Capacitors
3. Install HF Jumper
4. Test the Stage

Quadrature Clock Generator Bill of Materials (HF band option)

Check	Type	Category	Component	Count	Marking	Image
☐	Band-specific	Omit	omit for this band	2		
☐	Capacitor	SMT 1206	0.1 uF	1	(smt) black stripe	
☐	IC	SOIC-14	74AC74 Dual D FF	1	74AC74 ESD!!!	
☐	Resistor	1/6W	10 k 1/6W 5%	2	brn-blk-ora-gld	
☐	wire	Cutoff	shunt wire (cut-off lead)	1		

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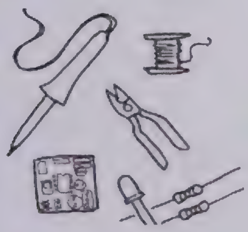
Detailed Build Steps

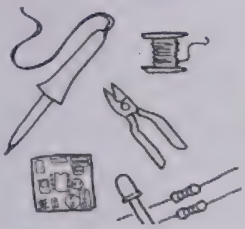


Install Voltage Divider Resistors

Pay careful attention to the orientation (S-N and N-S, respectively) of R10 and R11. Some builders have

⚠ inadvertently installed these with a horizontal orientation rather than a vertical orientation.

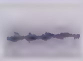
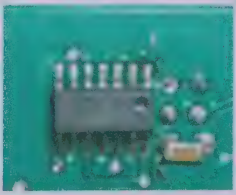
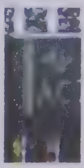
Check	Designation	Component (top/bottom)	Orientation	Marking	Image	Ban
☐	R10	10 k 1/6W 5% (top)	S-N	brn-blk-ora-gld		any
☐	R11	10 k 1/6W 5% (top)	N-S	brn-blk-ora-gld		any

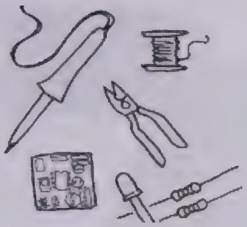


Install ICs and SMT Capacitors

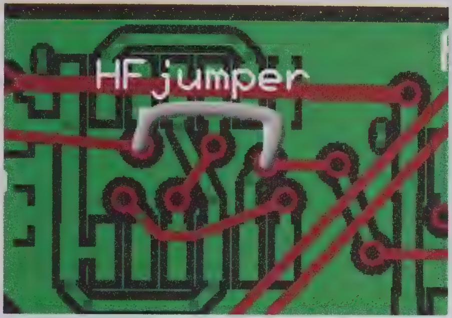
Here, you will install U6 (to get a divide-by-4) and, if building the LF option, U12 (to get a divide-by-16); also installed will be the appropriate SMT bypass capacitors.

⚠ U6 is required for both HF and LF options; U12 is only needed for the LF option. Watch out for the potential to install U6 in the wrong set of pads!

Check	Designation	Component (top/bottom)	Orientation	Marking	Image
☐	C36	0.1 uF ((bottom))	white pads	(smt) black stripe	
☐	C48	omit for this band ((bottom))	white pads		
☐	U06	74AC74 Dual D FF ((bottom))		74AC74 ESD!!!	
☐	U12	omit for this band ((bottom))			



Install HF Jumper

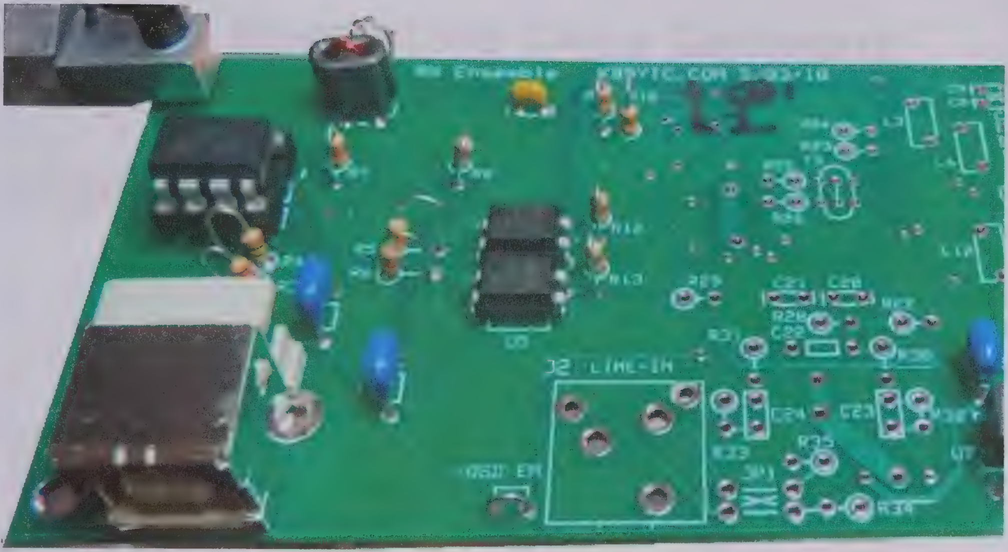


If building the HF option, omit U12 and Install the jumper wire to bypass U12 with the LO signal

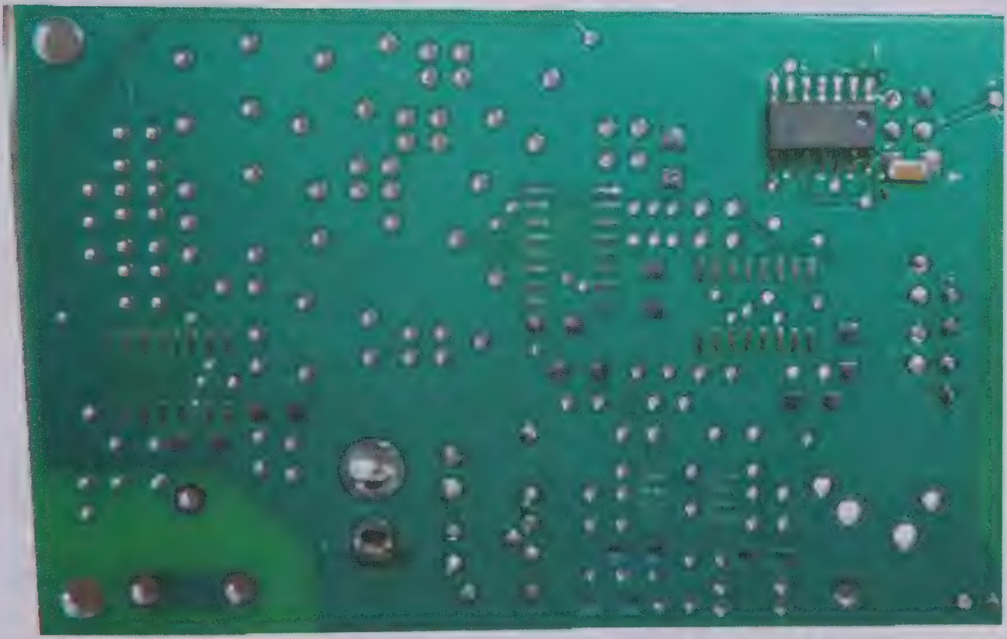
Check	Designation	Component (top/bottom)	Orientation	Marking	Image	Band
☐	hf-jmp	shunt wire (cut-off lead) (top)				HF

Completed Photos

View of Completed Topside



View of Completed Underside



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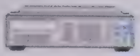
Test the Quadrature Clock Generator Stage



Quadrature Clock Generator - Current Draw

With both the USB cable and the power cable plugged in, measure the current draw in the positive power lead.

Measure the current draw with just the 12V power.

Note: the current draw will be slightly higher if you installed U12 as part of an LF option build

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Test Steps (if any)

Step	Test Point	UOM	Nominal	Author's	Builder's
0	Current draw WITH USB	mA	< 18	9.8	8
1	Current draw NO USB	mA	< 20	13.7	4

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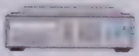

Quadrature Clock Generator - Test Voltage

Divider

⚠ When performing the following tests, you must apply [pwer to the board AND plug in the USB cable. Otherwise, results will not be as expected.

Plug in USB and power the board.

Measure the voltage on the R11 hairpin; you should see 50% of the %v rail voltage.

Depending upon your DMM, your measurements may vary. What we are looking for here is roughly half the 5 volt rail.

Troubleshooting the Voltage Divider

If you do not get the expected R11 value you expect, the possibilities are most likely that you have a short or you have mounted the wrong resistor value(s). For the latter case, you may want to use the utility Voltage Divider Calculator to enter your actual R11 value (Vout and see what resistance values might produce that voltage.

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Test Steps (if any)

Step	Test Point	UOM	Nominal	Author's	Builder's
0	R11 hairpin (WRT regular gnd)	V dc	2.5	2.46	

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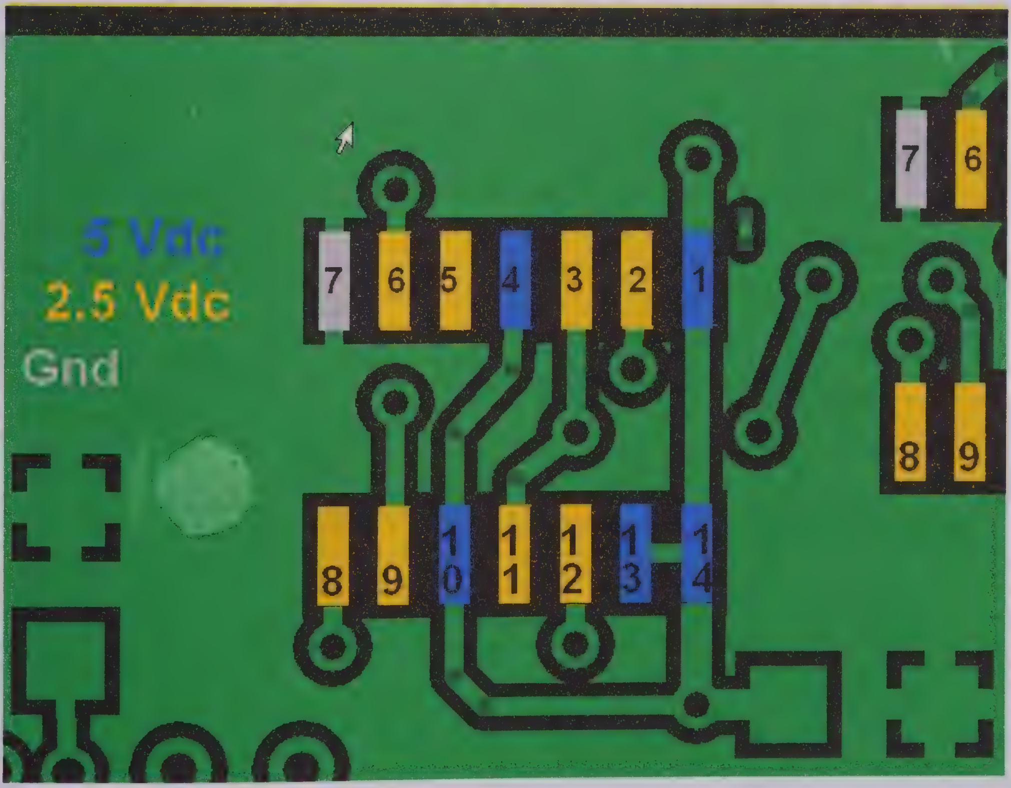
Quadrature Clock Generator - Divider Pin Voltages

Power USB and 12V. Then measure the voltages on the pins (and, separately, on the pads) of U6 (74AC74). Refer to the color codes on the graphic for the voltages.

Pins 3 and 11 will not show exactly 2.5Vdc because they have the additional AC component of the local oscillator signal from C3. The important idea is - for those pins which should nominally be 2.5Vdc - you do NOT want to see 0 or 5 Vdc!

If you are building the LF option, you should perform this test on both U12 and U6; otherwise, just test U6.



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Test Steps (if any)

Step	Test Point	UOM	Nominal	Author's	Builder's
1	Pin 1	Vdc	5	4.92	
2	Pin 2	Vdc	2.5	2.45	
3	Pin 3	Vdc	2 to 3	2.46	
4	Pin 4	Vdc	5	4.92	
5	Pin 5	Vdc	2.5	2.45	
6	Pin 6	Vdc	2.5	2.45	
7	Pin 7	Vdc	0 (GND)	0	
8	Pin 8	Vdc	2.5	2.45	
9	Pin 9	Vdc	2.5	2.45	
10	Pin 10	Vdc	5	4.92	
11	Pin 11	Vdc	2.5	2.46	
12	Pin 12	Vdc	2 - 3	2.45	
13	Pin 13	Vdc	5	4.92	
14	Pin 14	Vdc	5	4.92	

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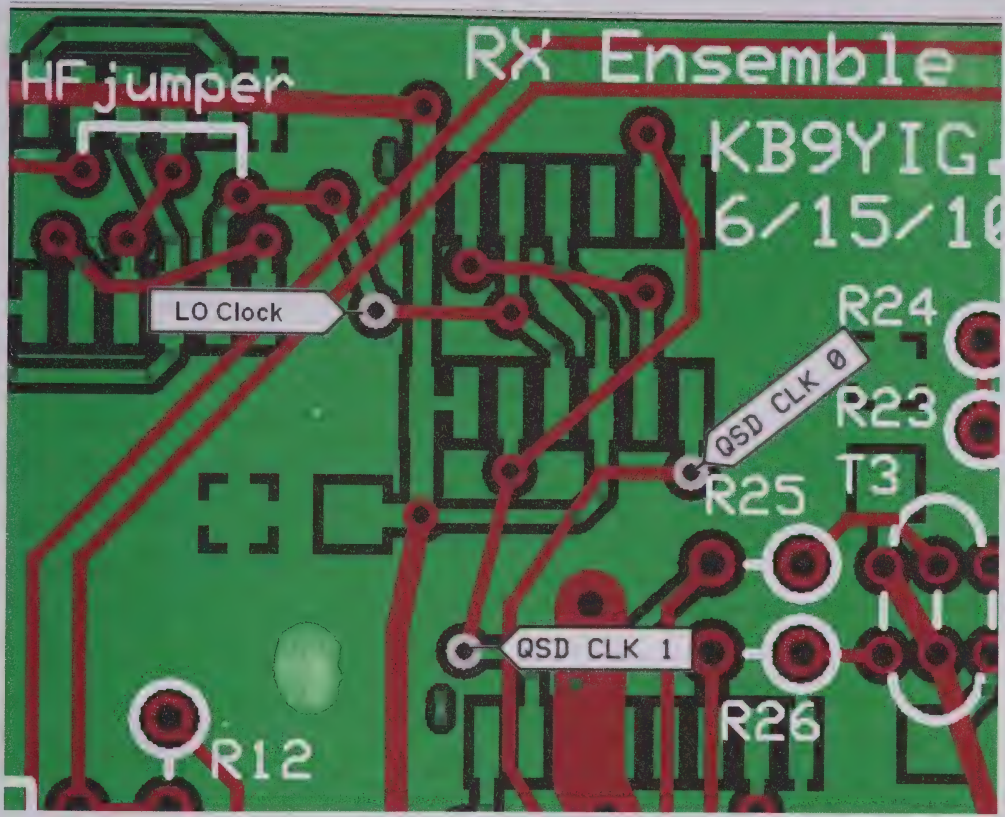
Quadrature Clock Generator - Quadrature Colck Generated Waveforms

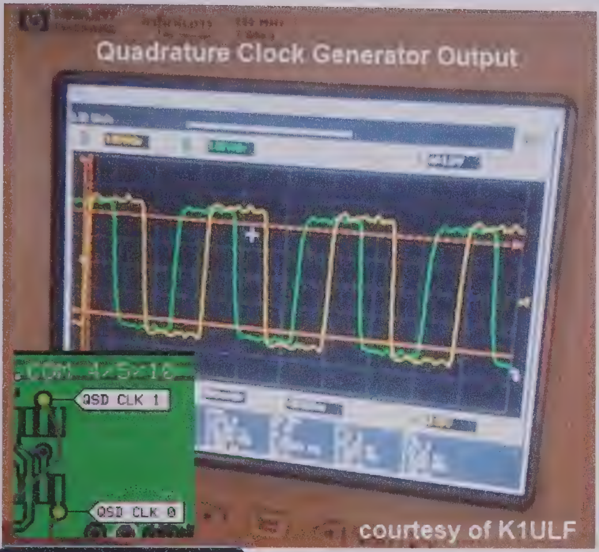
Set your board up to oscillate at a selected center frequency, e.g., 7.100 MHz.



If you have a dual trace scope available, probe the two "QSD CLK (n)" test points and you should get a waveform similar to the one shown here.

The testpoint marked "LO Clock" will provide the Si570's output frequency or, in the case of the LF option, that frequency divided by 4 (courtesy of U12).

Your mileage may vary, depending upon the desired center frequency you select and the quality of your scope (some scopes tend to have issues with these square waves - still, the scope should show two waveforms in quadrature at the desired center frequency).



Quadrature Clock Generator Output

courtesy of K1ULF

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Test Steps (if any)

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Next Stage: Band Pass Filters

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Ensemble RX II (HF/LF) Auto Band Pass Filters
Band: HF

Introduction

Band Specific Components

This stage involves band-specific components and is currently configured for the HF band. If you need to configure this page for a different band, click on the "Band" tab in the menu above. This would take you to the home page, where you can select the new band and then return to this page.

General Info About the Stage

This stage implements the automatic bandpass filtering circuit. The circuit uses two quad multiplexer switches to switch one of four bandpass filters into the QSD input. The filters provide continuous coverage, in four "chunks", from 1.8MHa through 30 MHz in the HF option and 0.180 MHz to 3.0 MHz in the LF option (with some under and overlaps).

Switching is automatic, via the two binary signals, "FL SEL 0" and "FL SEL 1". The ATTiny 85 Microcontroller has a built-in band plan (which the user can adjust, using the facilities in the CFGSR program) which associates any output frequency of the Local Oscillator to the most appropriate filter and issues the corresponding bits to "FL SEL 0" and "FL SEL 1", per the following truth table:

Filter Selection Truth Table

(Frequencies in the Low/High columns are given for the HF option, with the frequencies for the LF option shown inside of parentheses)

Sel 1 (R12)	Sel 0 (R13)	Band	Low HF (LF) MHz	High HF (LF) MHz
L	L	0	1 (0.180)	4 (0.480)
L	H	1	4 (0.400)	8 (0.800)
H	L	2	8 (0.800)	16 (1.6)
H	H	3	16 (1.6)	30 (3.0)

(SEL-0 is at the hairpin lead of R13; SEL-1 is at the hairpin lead of R12)

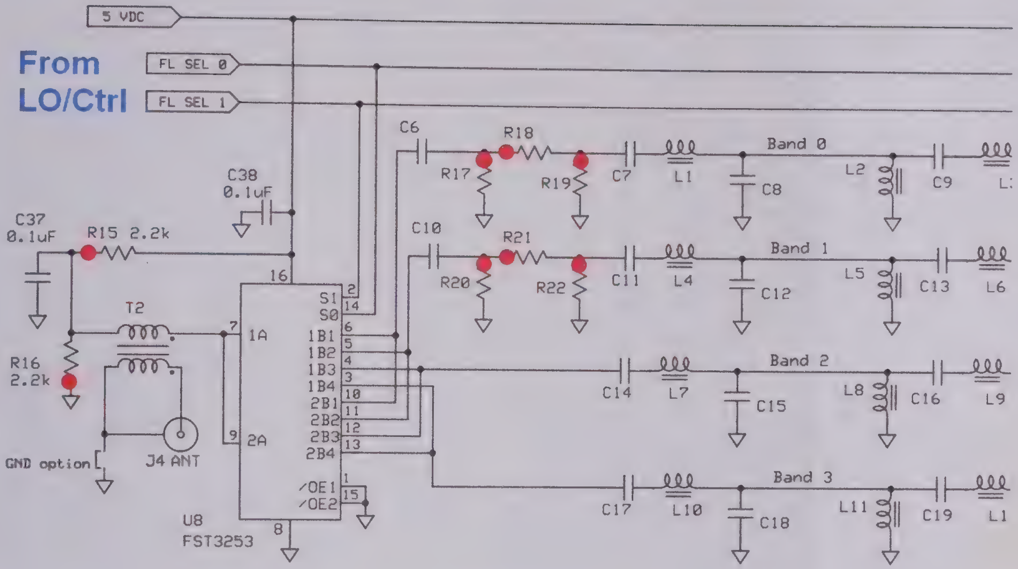
These notes detail the construction of each of the four bandpass filters, with a simple continuity test at the end of each filter's construction to verify soldering of the leads of the coils.

If you are unfamiliar with toroid and binocular inductor construction, please see the WB5RVZ Construction hints for inductors.

(Note: completed photos of this and the next stage were, unfortunately not taken at stage-end. The completed photos shown are from the final stage, with the uninstalled sections photoshopped out. Apologies.)

Theory of Operation

Stage Schematic



6/18/2010

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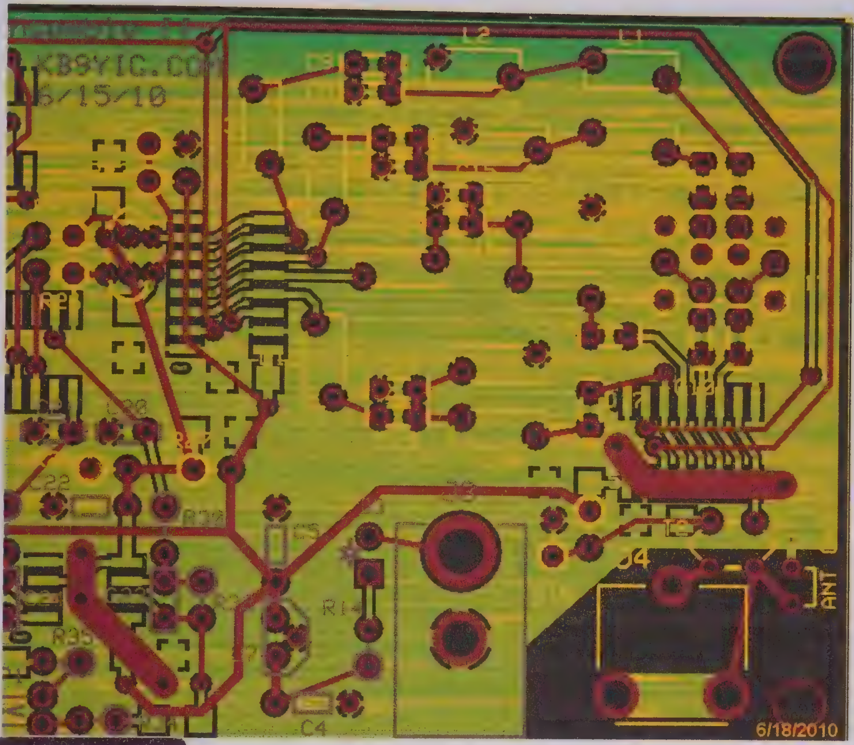
Click here for full schematic

(Red dots represent the "hairpin" (or left-hand or topmost) lead of the component)

Board Layouts

Board Top



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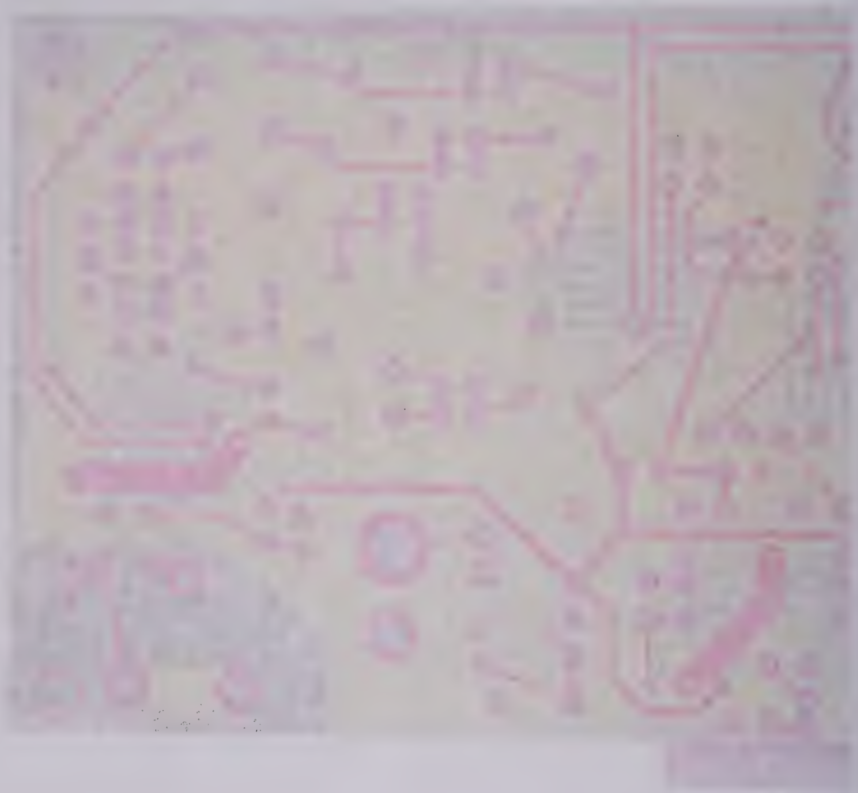
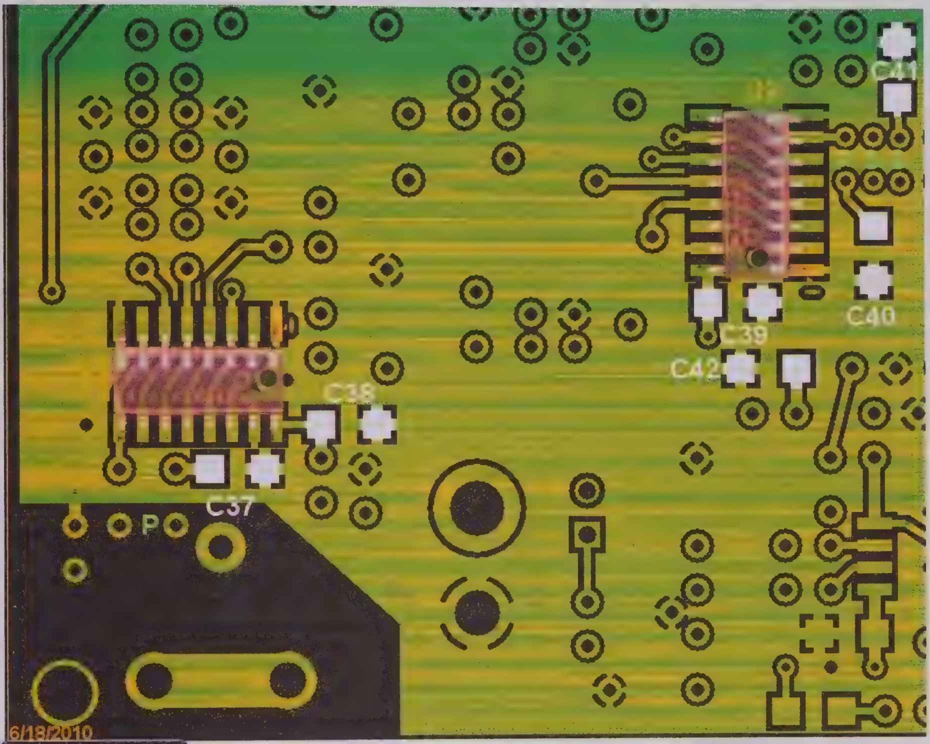
Board Bottom



[illegible]



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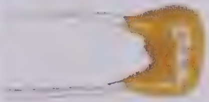
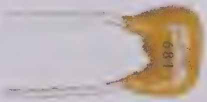
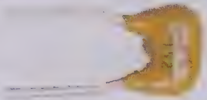
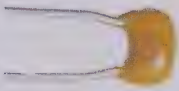
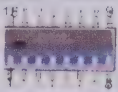
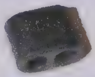
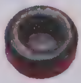
Summary Build Notes

1. Install BPF In/Out Components
2. Install and Continuity Test the Band 0 BPF
3. Install the Band 0 Inductors
4. Install the Band 0 Static Components
5. Install and Continuity Test the Band 1 BPF
6. Install the Band 1 Inductors
7. Install the Band 1 Static Components
8. Install and Continuity Test the Band 2 BPF
9. Install the Band 2 Inductors
10. Install the Band 2 Static Components
11. Install and Continuity Test the Band 3 BPF
12. Install the Band 3 Inductors
13. Install the Band 3 Static Components
14. Install Bottomside Components
15. Install Antenna Jack
16. Test the Stage

Auto Band Pass Filters Bill of Materials (HF band option)

Check	Type	Category	Component	Count	Marking	Image

☑	Capacitor	Ceramic	100 pF 5%	2	101	
☑	Capacitor	Ceramic	180 pF 5%	2	181	
☐	Capacitor	Ceramic	390 pF 5%	3	391	
☐	Capacitor	Ceramic	680 pF 5%	3	681	
☑	Capacitor	Ceramic	1500 pF 10%	2	152	
☑	Capacitor	Ceramic	0.047 uF 5%	2	473	
☐	Capacitor	SMT 1206	0.1 uF	6	(smt) black stripe	
☐	connector	Jack	BNC Connector Male - PCB mount	1		
☐	IC	SOIC-16	FST3253 mux/demux switch	2	FST3253 ESD!!!	
☐	inductor	Binocular core	BN-43-2402 (no markings!)	2	none	
☐	inductor	Toroid	T25-6 toroid core	6	yellow	
☐	inductor	Toroid	T30-2 toroid core	6	red	
☐	Inductor	coil	0.13uH: 7T #30 on T25-6 core	1	yellow	
☐	Inductor	coil	0.46uH: 13T #30 on T25-6 core	2	yellow	

☐	Inductor	coil	0.46uH: 10T #30(8in) on T30-2(red)	1	red	
☐	Inductor	coil	1uH: 19T #30(9in) on T25-6(yel)	2	yellow	
☐	inductor	Coil	2uH: 21T #30(13in) on T30-2(red)	2	red	
☐	Inductor	coil	2.6uH: 24T #30(15in) on T30-2(red)	1	red	
☐	Inductor	coil	5.5uH: 35T #30(20in) on T30-2(red)	2	red	
☐	Inductor	xfrmr	23.04uH: 4T(bi)T #30(12 (2x6)in) on BN43-2402	1		
☐	Inductor	xfrmr	23.04uH: 4T/2T(bi)T #30(12 (6/2x3)in) on BN43-2402	1		
☐	Inductor	coil	0.27uH: 10T #30 on T25-6 c(yellow)	1	yellow	
☐	Resistor	1/4W	10 ohm 1/4W 1%	2	br-blk-blk-gld-br	
☐	Resistor	1/6W	75 1/6W 5%	4	vio-grn-blk-gld	
☐	Resistor	1/6W	120 1/6W 5%	2	brn-red-brn-gld	
☐	Resistor	1/6W	2.2k 1/6W 5%	6	red-red-red-gld	
☐	wire	Cutoff	shunt wire (cut-off lead)	1		
☐	wire	Magnetic	Magnetic Wire, enameled #30	4		

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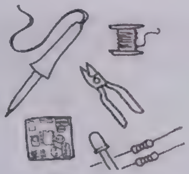
Detailed Build Steps



Install BPF In/Out Components

Inductor Information

Common Techniques:

- One turn:
  - For toroids, one turn is a single pass through the center hole.
  - For binocular cores, one turn is a pass in which the wire goes in the bottom, comes out the top, goes back in the other hole at the top, and comes out the other hole at the bottom.
- Bi (tri) filar means 2(3) equal lengths of wire. You get the bi(tri)filar strand by taking the length of wire specified for the primary winding, folding it into half(thirds), twisting it to 3~ twists per inch, and winding it over the primary winding. One end of such a strand will have two(three) leads; the other end will have a "hairpin" bend (and a single lead in the case of tri-filar).
- Multi-filar windings are usually done AFTER the uni-filar winding is done.
- Windings shoud be evenly spaced and ideally made such that the winding covers ~345 degrees of the toroid
- Inductance values given are for the single (uni-filar) winding. They are provided to help verify turn counts and core material selected.
- Toroid nomenclature provides the outside diameter of the toroid (in hundredths of an inch - the "30" in "T30-2"), and material code (the "2" in "T30-2"). Color codes used in these kits are:
  - 2=Red
  - 3=Gray
  - 6=Yellow
  - 7=White
  - 10=Black
  - 12=Green (with White on opposite side)

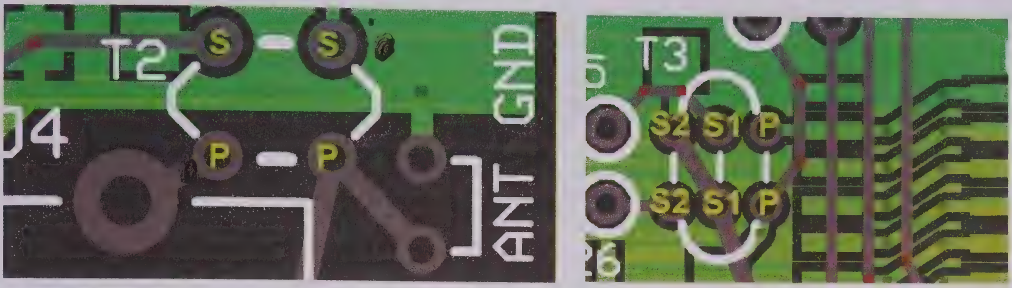
Inductors In This Step

T02

XFRMR: 23.04uH: 4T(bi)T #30(12 (2x6)in) on BN43-2402
Using a total of approximately 10 inches of #30 wire, wind 4 turns , bifilar, on a BN-43-2402 ferrite.Inductance of the single winding (usually the primary) is 23.04 uH.

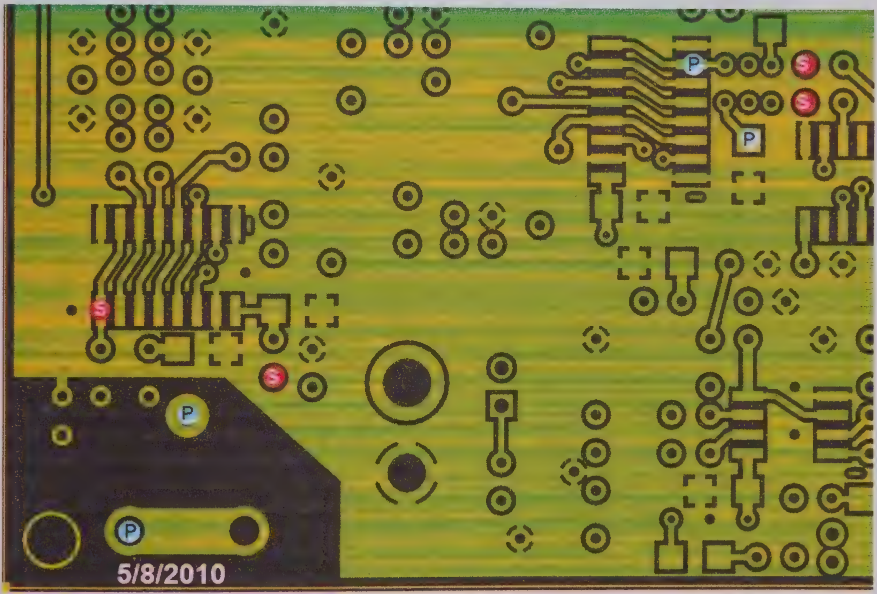
T03

XFRMR: 23.04uH: 4T/2T(bi)T #30(12 (6/2x3)in) on BN43-2402
Primary: Using approximately 7 inches of #30 wire, wind 4 turns on a BN-43-2402 ferrite.
Secondary: Using a total of 7 inches of #30 wire, wind 2 turns , bifilar, on the ferrite in the same direction as the primary winding. Inductance of the single winding (usually the primary) is 23.04 uH.



CT

Includes winding and installing the two binocular transformers, T2 and T3.

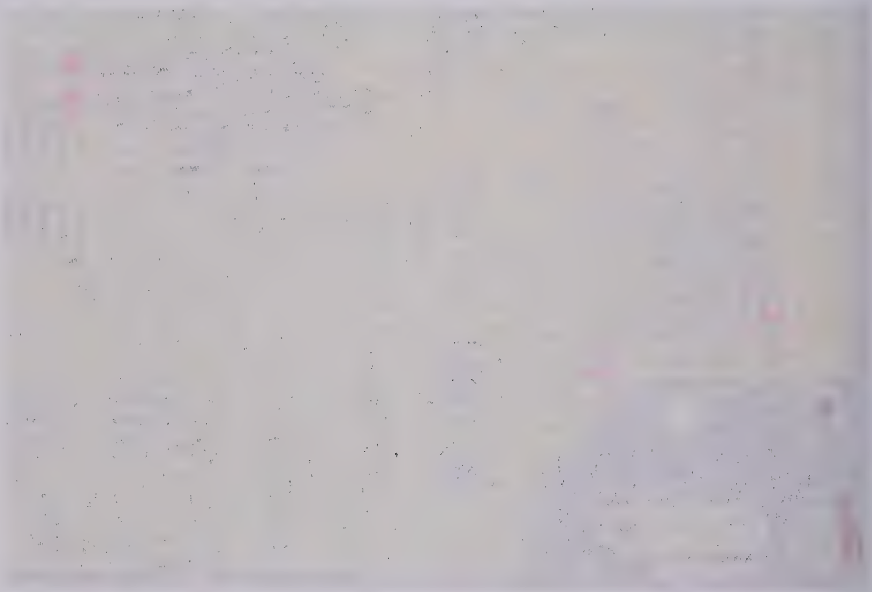


T2 has a single primary and a single secondary windings; T3 one primary and two secondary windings.

⚠ ALERT! Original Ensemble RXII PCB layouts have an error in the placement of the leads for T2, the Antenna isolation transformer. If the antenna isolation transformer is not connected properly then the outer of the antenna coax will be prone to common mode currents causing noise pickup on receive. The principle is that the grounded side of the isolation transformers should go to the same end of the primary and secondary. The two wires that come from the same hole in the binocular core.:must be switched (for one of the windings, primary orsecondary - your choice). See the article by Alan G4ZFQ for IMPORTANT details.

The T3 secondary windings are connected by a trace on the board such that the secondary winding ends not connected together are 180 degrees phase different. Only one secondary winding is connected through the QSD switches of U10 at any instant of time resulting in signal integration on capacitors C20 and C21. T3 also provides a 4:1 Z transformation from the BPF to the QSD circuit.

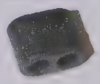
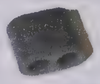
Once the transformers are wound and installed, you should turn the board over and run continuity tests on the primary and secondary windings, per the above diagram

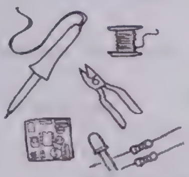


[illegible]

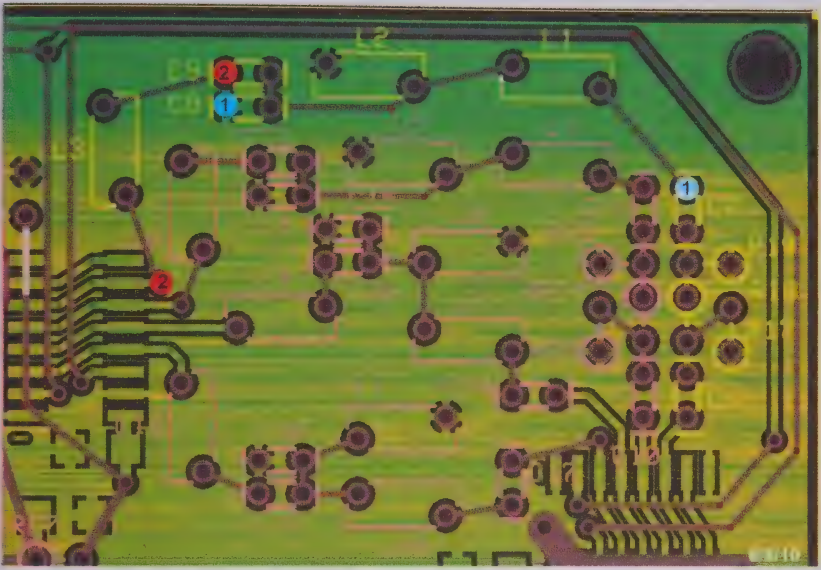
[illegible]

[illegible]

Check	Designation	Component (top/bottom)	Orientation	Marking	Image	Band	Notes
☐	R23	2.2k 1/6W 5% (top)	W-E	red-red-red-gld		any	
☐	T02	23.04uH: 4T(bi)T #30(12 (2x6)in) on BN43-2402 (top)				HF	⚠ Note: see above note about switchi leads.
☐	T02-core	BN-43-2402 (no markings!) (top)		none		any	
☐	T03	23.04uH: 4T/2T(bi)T #30(12 (6/2x3)in) on BN43-2402 (top)			23.04uH: 4T/2T(bi)T #30(12 (6/2x3)in) on BN43-2402	HF	
☐	T03-core	BN-43-2402 (no markings!) (top)		none		any	
☐	R15	2.2k 1/6W 5% (top)	N-S	red-red-red-gld		any	
☐	R16	2.2k 1/6W 5% (top)	N-S	red-red-red-gld		any	
☐	R24	2.2k 1/6W 5% (top)	W-E	red-red-red-gld		any	
☐	R25	10 ohm 1/4W 1% (top)	E-W	br-blk-blk-gld-br		any	
☐	R26	10 ohm 1/4W 1% (top)	E-W	br-blk-blk-gld-br		any	
☐	R27	2.2k 1/6W 5% (top)		red-red-red-gld		any	
☐	R28	2.2k 1/6W 5% (top)		red-red-red-gld		any	

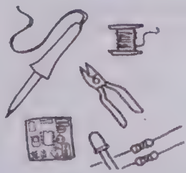


Install and Continuity Test the Band 0 BPF



In this step and the two steps following it, you will build the bandpass filter for the band 0 passband.

Check	Designation	Component (top/bottom)	Orientation	Marking	Image	Band	Notes
☐	magwire_165in	Magnetic Wire, enameled #30 (top)				any	



Install the Band 0 Inductors

Inductor Information

Common Techniques:

- One turn:
  - For toroids, one turn is a single pass through the center hole.
  - For binocular cores, one turn is a pass in which the wire goes in the bottom, comes out the top, goes back in the other hole at the top, and comes out the other hole at the bottom.
- Bi (tri) filar means 2(3) equal lengths of wire. You get the bi(tri)filar strand by taking the length of wire specified for the primary winding, folding it into half(thirds), twisting it to 3~ twists per inch, and winding it over the primary winding. One end of such a strand will have two(three) leads; the other end will have a "hairpin" bend (and a single lead in the case of tri-filar).
- Multi-filar windings are usually done AFTER the uni-filar winding is done.
- Windings shoud be evenly spaced and ideally made such that the winding covers ~345 degrees of the toroid
- Inductance values given are for the single (uni-filar) winding. They are provided to help verify turn counts and core material selected.
- Toroid nomenclature provides the outside diameter of the toroid (in hundredths of an inch - the "30"

in "T30-2"), and material code (the "2" in "T30-2"). Color codes used in these kits are:
  - 2=Red
  - 3=Gray
  - 6=Yellow
  - 7=White
  - 10=Black
  - 12=Green (with White on opposite side)

Inductors In This Step

L01

COIL: 5.5uH: 35T #30(20in) on T30-2(red)
Using approximately 21 inches of #30 wire, wind 35 turns on a 0.30 inch od T30-2(red) ferrite. Inductance = 5.50 uH.

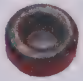
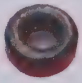
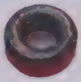
L02

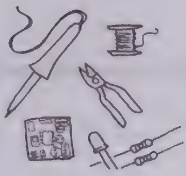
COIL: 2.6uH: 24T #30(15in) on T30-2(red)
Using approximately 15 inches of #30 wire, wind 24 turns on a 0.30 inch od T30-2(red) ferrite. Inductance = 2.60 uH.

L03

COIL: 5.5uH: 35T #30(20in) on T30-2(red)
Using approximately 21 inches of #30 wire, wind 35 turns on a 0.30 inch od T30-2(red) ferrite. Inductance = 5.50 uH.

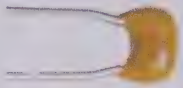
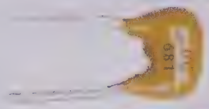
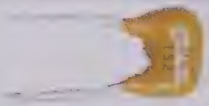
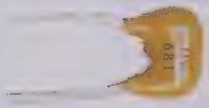
First, you want to wind and install the coils and then continuity test them. The continuity test checks for continuity between the points labeled "1" and then tests the continuity between the points labeled "2". Wherever possible, the test points have been assigned to vias removed from but electrically connected to the coils' vias, so as to give a good test of the soldering.

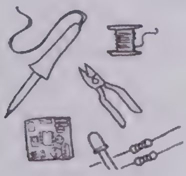
Check	Designation	Component (top/bottom)	Orientation	Marking	Image	Band	Notes
☐	L01	5.5uH: 35T #30(20in) on T30-2(red) (top)		red		HF	
☐	L01-core	T30-2 toroid core (top)		red		HF	
☐	L02	2.6uH: 24T #30(15in) on T30-2(red) (top)		red		HF	
☐	L02-core	T30-2 toroid core (top)		red		HF	
☐	L03	5.5uH: 35T #30(20in) on T30-2(red) (top)		red		HF	
☐	L03-core	T30-2 toroid core (top)		red		HF	



Install the Band 0 Static Components

Once you have successfully verified continuity, you can proceed to install the remaining parts for the passband.

Check	Designation	Component (top/bottom)	Orientation	Marking	Image	Band	Notes
☐	C06	0.047 uF 5% (top)	vert	473		HF	(jumper for LF)
☐	C07	680 pF 5% (top)	vert	681		HF	
☐	C08	1500 pF 10% (top)	horiz	152		HF	
☐	C09	680 pF 5% (top)	horiz	681		HF	
☐	R17	75 1/6W 5% (top)	S-N	vio-grn-blk-gld		HF	
☐	R18	120 1/6W 5% (top)	N-S	brn-red-brn-gld		HF	(jumper for LF)
☐	R19	75 1/6W 5% (top)	E-W	vio-grn-blk-gld		HF	



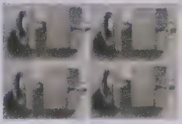
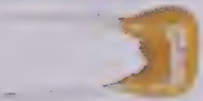
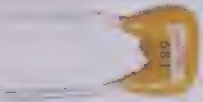
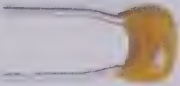
Install and Continuity Test the Band 1 BPF

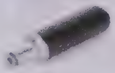
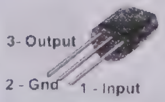
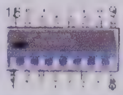
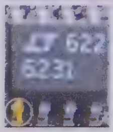
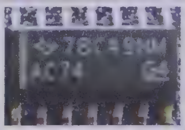
Home Bands Power Supply USB Power LO Dividers BPFs QSD

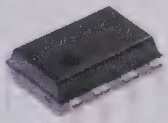
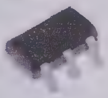
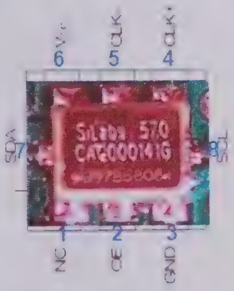
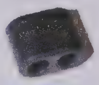
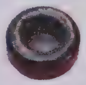
Op Amps BOM BOM X-Ref Inventory Revisions WB5RVZ

Ensemble RX II (HF/LF) Bill of Materials
Band: HF

Project Bill of Materials

Check	Type	Category	Component	Count	Marking	Image
[ ]	Band-specific	Omit	omit for this band	2		
[ ]	boardhdw	HDW	4 X #4-40 hdw (nut, bolt, washer, spacer)	1		
[✓]	Capacitor	Ceramic	100 pF 5%	2	101	
[✓]	Capacitor	Ceramic	180 pF 5%	2	181	
[✓]	Capacitor	Ceramic	390 pF 5%	5	391	
[✓]	Capacitor	Ceramic	680 pF 5%	3	681	
[✓]	Capacitor	Ceramic	1500 pF 10%	2	152	
[✓]	Capacitor	Ceramic	0.01 uF	1	103	
[✓]	Capacitor	Ceramic	0.047 uF 5%	4	473	

[ ]	Capacitor	SMT 1206	0.1 uF	19	(smt) black stripe	
[ ]	Capacitor	Ceramic	4.7 uF 10% 16V X7R RAD	5	475	
[ ]	connector	Jack	BNC Connector Male - PCB mount	1		
[ ]	connector	Jack-RA	3.5mm stereo jack - PCB mount (rt-angle)	1		
[ ]	Connector	Jack-RA	DC Power Jack PCB Mount (rt-angle) 2.5mm	1		
[ ]	Connector	Plug	DC Power Plug 5.5/2.5mm Pos Ctr	1		
[ ]	connector	Jack-RA	USB-B pcb jack (rt-angle)	1		
[ ]	Diode	Axial	1N4003	1	1N4003	
[ ]	Diode	Axial	BZX55C3V3 3.3V zener diode	2	BZX55C	
[ ]	IC	TO-92	LM78L05 voltage regulator	1	LM78L05	
[ ]	IC	SOIC-16	FST3253 mux/demux switch	3	FST3253	
[ ]	IC	SOIC-8	LT6231 dual op-amp	1	LT6231	
[ ]	IC	SOIC-14	74AC74 Dual D FF	1	74AC74	

[ ]	IC	DIP 8	ATtiny 85-20 PU w/V15.12 Firmware	1	AVR ATTINY85-20PU	
[ ]	IC	DIP-4	LTV-817 Opto-Isolator	2	LTV 817	
[ ]	IC	SOT-23-5	LP2992AIM5-3.3V regulator	1	LFEA	
[ ]	IC	I2C	Si570 Programmable Oscillator	1	SiLabs 570	 6 5 CLK- 4 CLK+ SDA 7 SiLabs 570 CAZ000141G 8 SCL 1 NC 2 OE 3 GND
[ ]	inductor	Binocular core	BN-43-2402 (no markings!)	3	none	
[ ]	inductor	Toroid	T25-6 toroid core	6	yellow	
[ ]	inductor	Toroid	T30-2 toroid core	6	red	
[ ]	Inductor	coil	0.13uH: 7T #30 on T25-6 core	1	yellow	0.13uH: 7T #30 on T25-6 core
[ ]	Inductor	coil	0.46uH: 13T #30 on T25-6 core	2	yellow	0.46uH: 13T #30 on T25-6 core
[ ]	Inductor	coil	0.46uH: 10T #30(8in) on T30-2(red)	1	red	
[ ]	Inductor	coil	1uH: 19T #30(9in) on T25-6(yel)	2	yellow	
[ ]	inductor	Coil	2uH: 21T #30(13in) on T30-2(red)	2	red	
[ ]	Inductor	coil	2.6uH: 24T #30(15in) on T30-2(red)	1	red	
[ ]	Inductor	coil	5.5uH: 35T #30(20in) on T30-2(red)	2	red	

[ ]	Inductor	xfrmr	5.76uH: 2T(bi)T #30(8 (2x4)in) on BN43-2402	1		
[ ]	Inductor	xfrmr	23.04uH: 4T(bi)T #30(12 (2x6)in) on BN43-2402	1		
[ ]	Inductor	xfrmr	23.04uH: 4T/2T(bi)T #30(12 (6/2x3)in) on BN43-2402	1		23.04uH: 4T/2T(bi)T #30(12 (6/2x3)in) on BN43-2402
[ ]	Inductor	coil	0.27uH: 10T #30 on T25-6 c(yellow)	1	yellow	0.27uH: 10T #30 on T25-6 c(yellow)
[ ]	PCB	Main Board	Ensemble RX PCB (board)	1		
[ ]	Resistor	1/4W	10 ohm 1/4W 1%	4	br-blk-blk-gld-br	
[ ]	Resistor	1/6W	68 1/6W 5%	3	bl-gry-blk-gld	
[ ]	Resistor	1/6W	75 1/6W 5%	4	vio-grn-blk-gld	
[ ]	Resistor	1/6W	120 1/6W 5%	4	brn-red-brn-gld	
[ ]	Resistor	1/6W	2.2k 1/6W 5%	12	red-red-red-gld	
[ ]	Resistor	1/4W	4.99 k 1/4W 1%	2	y-w-w-br-br	
[ ]	Resistor	1/6W	10 k 1/6W 5%	5	brn-blk-ora-gld	
[ ]	Resistor	1/6W	1 M 1/6W 5%	1	brn-blk-grn-gld	
[ ]	socket	Socket	8 pin dip socket	1		
[ ]	wire	Cutoff	shunt wire (cut-off lead)	5		
[ ]	wire	Magnetic	Magnetic Wire, enameled #30	6		

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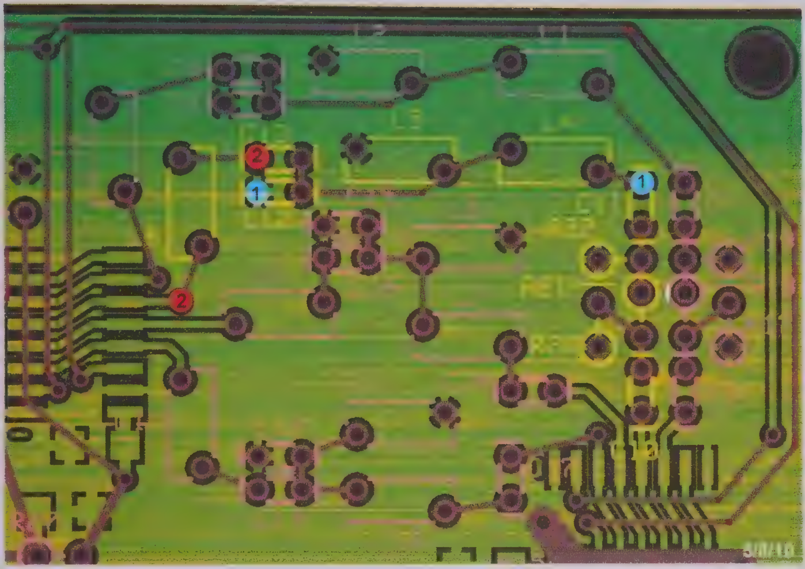
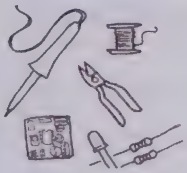


In this step and the two steps following it, you will build the bandpass filter for the band 1 passband.

First, you want to wind and install the coils and then continuity test them. The continuity test checks for continuity between the points labeled "1" and then tests the continuity between the points labeled "2". Wherever possible, the test points have been assigned to vias removed from but electrically connected to the coils' vias, so as to give a good test of the soldering.

Once you have successfully verified continuity, you can proceed to install the remaining parts for the passband.

Check	Designation	Component (top/bottom)	Orientation	Marking	Image	Band	Notes
☐	magwire_90in	Magnetic Wire, enameled #30 (top)				any	



Install the Band 1 Inductors

Inductor Information

Common Techniques:

- One turn:
    - For toroids, one turn is a single pass through the center hole.
    - For binocular cores, one turn is a pass in which the wire goes in the bottom, comes out the top, goes back in the other hole at the top, and comes out the other hole at the bottom.
- Bi (tri) filar means 2(3) equal lengths of wire. You get the bi(tri)filar strand by taking the length of wire specified for the primary winding, folding it into half(thirds), twisting it to 3~ twists per inch,

and winding it over the primary winding. One end of such a strand will have two(three) leads; the other end will have a "hairpin" bend (and a single lead in the case of tri-filar).

- Multi-filar windings are usually done AFTER the uni-filar winding is done.
- Windings shoud be evenly spaced and ideally made such that the winding covers ~345 degrees of the toroid
- Inductance values given are for the single (uni-filar) winding. They are provided to help verify turn counts and core material selected.
- Toroid nomenclature provides the outside diameter of the toroid (in hundredths of an inch - the "30" in "T30-2"), and material code (the "2" in "T30-2"). Color codes used in these kits are:
    - 2=Red
    - 3=Gray
    - 6=Yellow
    - 7=White
    - 10=Black
    - 12=Green (with White on opposite side)

Inductors In This Step

L04

COIL: 2uH: 21T #30(13in) on T30-2(red)
Using approximately 14 inches of #30 wire, wind 21 turns on a 0.30 inch od T30-2(red) ferrite. Inductance = 2.00 uH.

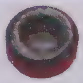
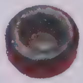
L05

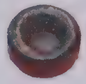
COIL: 0.46uH: 10T #30(8in) on T30-2(red)
Using approximately 9 inches of #30 wire, wind 10 turns on a 0.30 inch od T30-2(red) ferrite. Inductance = 0.46 uH.

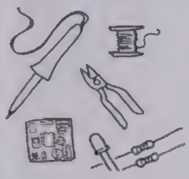
L06

COIL: 2uH: 21T #30(13in) on T30-2(red)
Using approximately 14 inches of #30 wire, wind 21 turns on a 0.30 inch od T30-2(red) ferrite. Inductance = 2.00 uH.

First, you want to wind and install the coils and then continuity test them. The continuity test checks for continuity between the points labeled "1" and then tests the continuity between the points labeled "2". Wherever possible, the test points have been assigned to vias removed from but electrically connected to the coils' vias, so as to give a good test of the soldering.

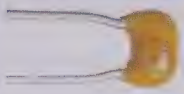
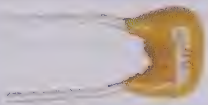
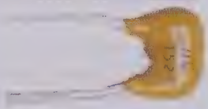
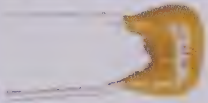
Check	Designation	Component (top/bottom)	Orientation	Marking	Image	Band	Notes
☐	L04-core	T30-2 toroid core (top)		red		any	
☐	L05	0.46uH: 10T #30(8in) on T30-2(red) (top)		red		HF	
☐	L05-core	T30-2 toroid core (top)		red		any	
☐	L04	2uH: 21T #30(13in) on T30-2(red) (top)		red		HF	

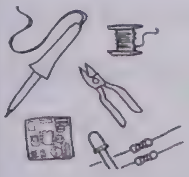
☐	L06	2uH: 21T #30(13in) on T30-2(red) (top)		red		HF	
☐	L06-core	T30-2 toroid core (top)		red		any	



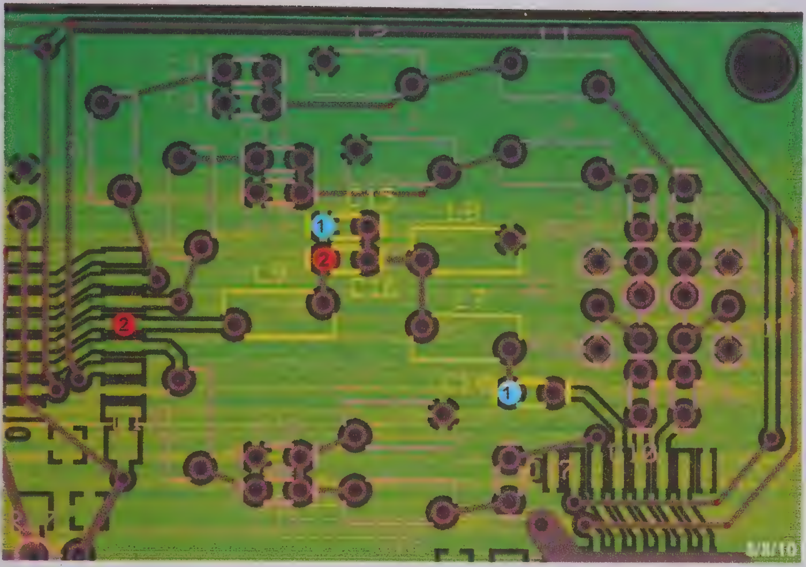
Install the Band 1 Static Components

Once you have successfully verified continuity, you can proceed to install the remaining parts for the passband.

Check	Designation	Component (top/bottom)	Orientation	Marking	Image	Band	Notes
☐	C10	0.047 uF 5% (top)	vert	473		HF	(jumper for LF)
☐	C11	390 pF 5% (top)	vert	391		HF	
☐	C12	1500 pF 10% (top)	horiz	152		HF	
☐	C13	390 pF 5% (top)	horiz	391		HF	
☐	R20	75 1/6W 5% (top)	S-N	vio-grn-blk-gld		HF	
☐	R21	120 1/6W 5% (top)	N-S	brn-red-brn-gld		HF	(jumper for LF)
☐	R22	75 1/6W 5% (top)	W-E	vio-grn-blk-gld		HF	



Install and Continuity Test the Band 2 BPF

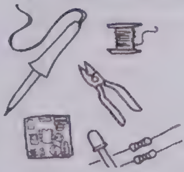


In this step and the two steps following it, you will build the bandpass filter for the band 2 passband.

First, you want to wind and install the coils and then continuity test them. The continuity test checks for continuity between the points labeled "1" and then tests the continuity between the points labeled "2". Wherever possible, the test points have been assigned to vias removed from but electrically connected to the coils' vias, so as to give a good test of the soldering.

Once you have successfully verified continuity, you can proceed to install the remaining parts for the passband.

Check	Designation	Component (top/bottom)	Orientation	Marking	Image	Band	Notes
☐	magwire_67in	Magnetic Wire, enameled #30 (top)				any	



Install the Band 2 Inductors

Inductor Information

Common Techniques:

- One turn:
    - For toroids, one turn is a single pass through the center hole.
    - For binocular cores, one turn is a pass in which the wire goes in the bottom, comes out the top, goes back in the other hole at the top, and comes out the other hole at the bottom.
- Bi (tri) filar means 2(3) equal lengths of wire. You get the bi(tri)filar strand by taking the length of wire specified for the primary winding, folding it into half(thirds), twisting it to 3~ twists per inch, and winding it over the primary winding. One end of such a strand will have two(three) leads; the

other end will have a "hairpin" bend (and a single lead in the case of tri-filar).
- Multi-filar windings are usually done AFTER the uni-filar winding is done.
- Windings shoud be evenly spaced and ideally made such that the winding covers ~345 degrees of the toroid
- Inductance values given are for the single (uni-filar) winding. They are provided to help verify turn counts and core material selected.
- Toroid nomenclature provides the outside diameter of the toroid (in hundredths of an inch - the "30" in "T30-2"), and material code (the "2" in "T30-2"). Color codes used in these kits are:
  - 2=Red
  - 3=Gray
  - 6=Yellow
  - 7=White
  - 10=Black
  - 12=Green (with White on opposite side)

Inductors In This Step

L07

COIL: 1uH: 19T #30(9in) on T25-6(yel)
Using approximately 11 inches of #30 wire, wind 19 turns on a 0.25 inch od T25-6(yellow) ferrite.
Inductance = 1.00 uH.

L08

COIL: 0.27uH: 10T #30 on T25-6 c(yellow)
Using approximately 7 inches of #30 wire, wind 10 turns on a 0.25 inch od T25-6(yellow) ferrite.
Inductance = 27.00 uH.

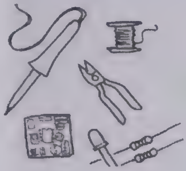
L09

COIL: 1uH: 19T #30(9in) on T25-6(yel)
Using approximately 11 inches of #30 wire, wind 19 turns on a 0.25 inch od T25-6(yellow) ferrite.
Inductance = 1.00 uH.

First, you want to wind and install the coils and then continuity test them. The continuity test checks for continuity between the points labeled "1" and then tests the continuity between the points labeled "2". Wherever possible, the test points have been assigned to vias removed from but electrically connected to the coils' vias, so as to give a good test of the soldering.

Check	Designation	Component (top/bottom)	Orientation	Marking	Image	Band	Notes
☐	L07	1uH: 19T #30(9in) on T25-6(yel) (top)		yellow		HF	
☐	L07-core	T25-6 toroid core (top)		yellow		HF	
☐	L08	0.27uH: 10T #30 on T25-6 c(yellow) (top)		yellow	0.27uH: 10T #30 on T25-6 c(yellow)	HF	changed from #24 wire
☐	L08-core	T25-6 toroid core (top)		yellow		HF	
☐	L09	1uH: 19T #30(9in) on T25-6(yel)		yellow		HF	

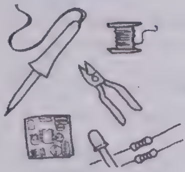
		(top)					
☐	L09-core	T25-6 toroid core (top)		yellow		HF	



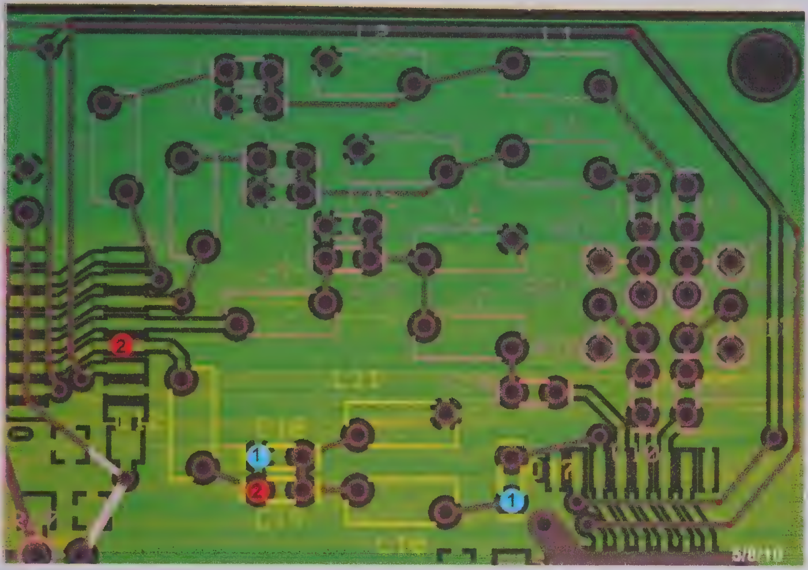
Install the Band 2 Static Components

Once you have successfully verified continuity, you can proceed to install the remaining parts for the passband.

Check	Designation	Component (top/bottom)	Orientation	Marking	Image	Band	Notes
☐	C14	180 pF 5% (top)	horiz	181		HF	
☐	C15	680 pF 5% (top)	horiz	681		HF	
☐	C16	180 pF 5% (top)	horiz	181		HF	



Install and Continuity Test the Band 3 BPF

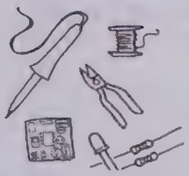


In this step and the two steps following it, you will build the bandpass filter for the band 3 passband.

First, you want to wind and install the coils and then continuity test them. The continuity test checks for continuity between the points labeled "1" and then tests the continuity between the points labeled "2". Wherever possible, the test points have been assigned to vias removed from but electrically connected to the coils' vias, so as to give a good test of the soldering.

Once you have successfully verified continuity, you can proceed to install the remaining parts for the passband.

Check	Designation	Component (top/bottom)	Orientation	Marking	Image	Band	Notes
☐	magwire_47in	Magnetic Wire, enameled #30 (top)				any	

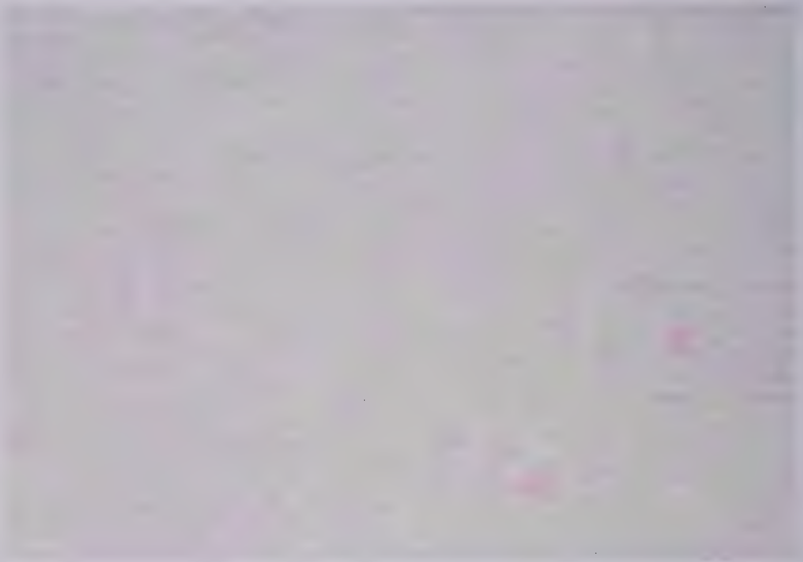


Install the Band 3 Inductors

Inductor Information

Common Techniques:

- One turn:
    - For toroids, one turn is a single pass through the center hole.
    - For binocular cores, one turn is a pass in which the wire goes in the bottom, comes out the top, goes back in the other hole at the top, and comes out the other hole at the bottom.
- Bi (tri) filar means 2(3) equal lengths of wire. You get the bi(tri)filar strand by taking the length of wire specified for the primary winding, folding it into half(thirds), twisting it to 3~ twists per inch,



and winding it over the primary winding. One end of such a strand will have two(three) leads; the other end will have a "hairpin" bend (and a single lead in the case of tri-filar).

- Multi-filar windings are usually done AFTER the uni-filar winding is done.
- Windings shoud be evenly spaced and ideally made such that the winding covers ~345 degrees of the toroid
- Inductance values given are for the single (uni-filar) winding. They are provided to help verify turn counts and core material selected.
- Toroid nomenclature provides the outside diameter of the toroid (in hundredths of an inch - the "30" in "T30-2"), and material code (the "2" in "T30-2"). Color codes used in these kits are:
    - 2=Red
    - 3=Gray
    - 6=Yellow
    - 7=White
    - 10=Black
    - 12=Green (with White on opposite side)

Inductors In This Step

L10

COIL: 0.46uH: 13T #30 on T25-6 core
Using approximately 8 inches of #30 wire, wind 13 turns on a 0.25 inch od T25-6(yellow) ferrite.
Inductance = 0.46 uH.

L11

COIL: 0.13uH: 7T #30 on T25-6 core
Using approximately 6 inches of #30 wire, wind 7 turns on a 0.25 inch od T25-6(yellow) ferrite.
Inductance = 0.13 uH.

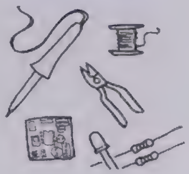
L12

COIL: 0.46uH: 13T #30 on T25-6 core
Using approximately 8 inches of #30 wire, wind 13 turns on a 0.25 inch od T25-6(yellow) ferrite.
Inductance = 0.46 uH.

First, you want to wind and install the coils and then continuity test them. The continuity test checks for continuity between the points labeled "1" and then tests the continuity between the points labeled "2". Wherever possible, the test points have been assigned to vias removed from but electrically connected to the coils' vias, so as to give a good test of the soldering.

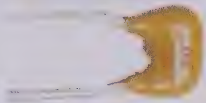
Check	Designation	Component (top/bottom)	Orientation	Marking	Image	Band	Notes
☐	L10	0.46uH: 13T #30 on T25-6 core (top)		yellow	0.46uH: 13T #30 on T25-6 core	HF	changed from #24 wire
☐	L10-core	T25-6 toroid core (top)		yellow		HF	
☐	L11	0.13uH: 7T #30 on T25-6 core (top)		yellow	0.13uH: 7T #30 on T25-6 core	HF	changed from #24 wire
☐	L11-core	T25-6 toroid core (top)		yellow		HF	
☐	L12	0.46uH: 13T #30 on T25-6		yellow	0.46uH: 13T #30	HF	changed from

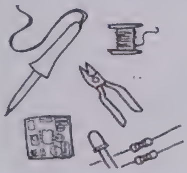
		core (top)			on T25-6 core		#24 wire
☐	L12-core	T25-6 toroid core (top)		yellow		HF	



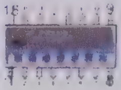
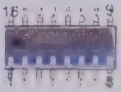
Install the Band 3 Static Components

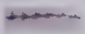
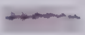
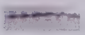
Once you have successfully verified continuity, you can proceed to install the remaining parts for the passband.

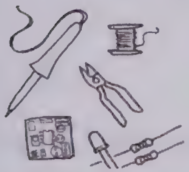
Check	Designation	Component (top/bottom)	Orientation	Marking	Image	Band	Notes
☐	C17	100 pF 5% (top)	vert	101		HF	
☐	C18	390 pF 5% (top)	horiz	391		HF	
☐	C19	100 pF 5% (top)	horiz	101		HF	



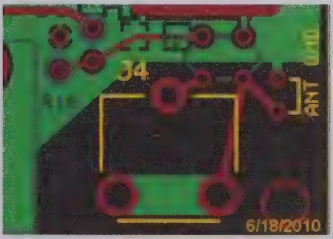
Install Bottomside Components

Check	Designation	Component (top/bottom)	Orientation	Marking	Image	Band	Notes
☐	U08	FST3253 mux/demux switch ((bottom))		FST3253 ESD!!!		any	ESD Take extrer care workir with t compc Alway: ESD precau
☐	U09	FST3253 mux/demux switch ((bottom))		FST3253 ESD!!!		any	ESD Take extrer care workir

							with t compc Alway ESD precau
☐	C37	0.1 uF ((bottom))	white pads	(smt) black stripe		any	
☐	C38	0.1 uF ((bottom))	white pads	(smt) black stripe		any	
☐	C39	0.1 uF ((bottom))	white pads	(smt) black stripe		any	
☐	C40	0.1 uF ((bottom))	white pads	(smt) black stripe		any	
☐	C41	0.1 uF ((bottom))	white pads	(smt) black stripe		any	
☐	C42	0.1 uF ((bottom))	white pads	(smt) black stripe		any	



Install Antenna Jack



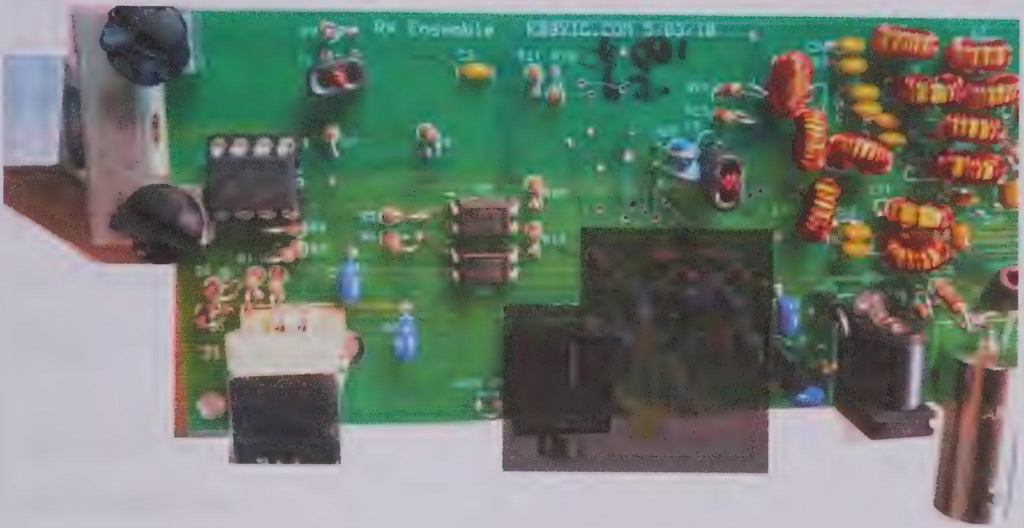
Note that there is an optional grounding via for the return side of the antenna connection. Normally, you would NOT want to ground this to regular circuit ground. However, there is some further discussion of this issue in this message thread in the Softrock40 reflector. One message suggested substituting a 4.7k ohm resistor for the grounding jumper to eliminate 60 Hz hum in the rx.

Check	Designation	Component (top/bottom)	Orientation	Marking	Image	Band	Notes
☐	J04	BNC Connector Male - PCB mount (top)				any	
☐	jmpr_ant	shunt wire (cut-off lead) (top)				any	(see note)

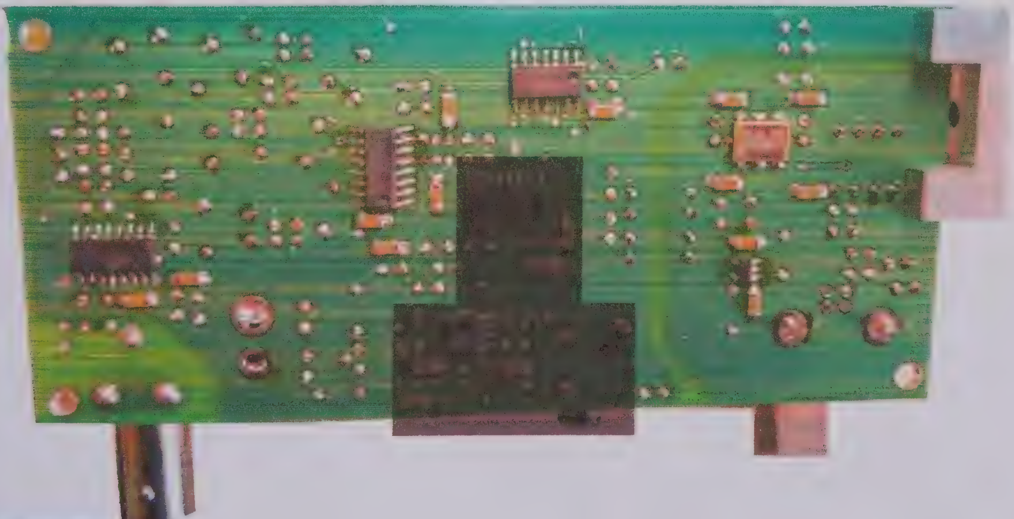
}

Completed Photos

View of Completed Topside



View of Completed Underside



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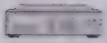
Test the Auto Band Pass Filters Stage



Auto Band Pass Filters - Voltage Divider Tests

With Power and USB connected, test the output of the three voltage dividers in this stage. Each should yield approximately one-half the voltage on the 5V rail.

Trouble-Shooting the Voltage Dividers

If either of the two voltage dividers does not yield the expected value, check to be certain that the resistors are all 2.2K (red-red-red-gld). You may also want to use the Utility Voltage Divider Calculator to plug in your actually measured voltage and calculate the resistor values that would cause your unexpected result.

Trouble Shooting R15/R16

Assuming you have the correct resistors and you are getting near zero at the junction, look for something that could short that junction to ground:

- C37
- T2 (windings shorted together)
- soldering on R16

Trouble Shooting R23/R24

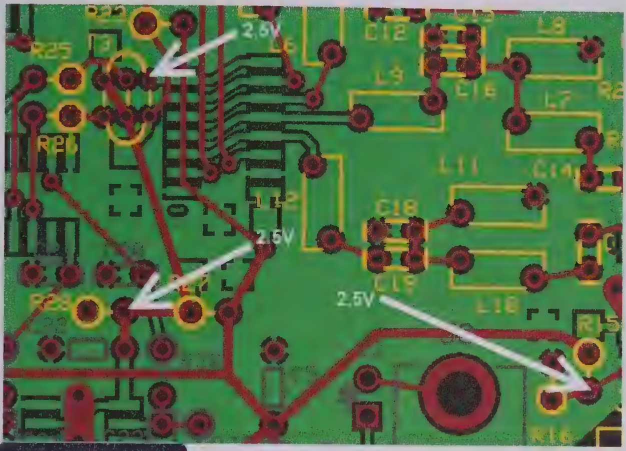
Assuming you have the correct resistors and you are getting near zero at the junction, look for something that could short that junction to ground:

- C40
- T3 (windings shorted together)
- soldering on R24

Trouble Shooting R28/R27

Assuming you have the correct resistors and you are getting near zero at the junction, look for something that could short that junction to ground:

- C42
- C41
- soldering on R28



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Test Steps (if any)

Step	Test Point	UOM	Nominal	Author's	Builder's
1	R15 Hairpin lead (R15/R16 voltage divider)	V dc	2.5	2.47	
2	Either of the Primary leads of T3 (R23/R24 voltage divider)	V dc	2.5	2.47	
3	R28 Hairpin lead (R27/R28 voltage divider)	V dc	2.5	2.47	

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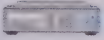

Auto Band Pass Filters - Pin Voltages on the Ics

Run the Filter Selection Test from the LO and Control Stage, only instead of measuring the voltages at the hairpin leads of R12 and R13, measure the voltages at the 2 and 14 PINS (not the pads) of U8 and U9. This will validate that the pins were correctly soldered to the pads and are getting the switching signals.

Perform the tests below for each of U8 and U9

If you are building the LF option, you will need to changet the frequencies to ones that are within the pass band of each filter:

Band	Midband (kHz)
Band 0	330
Band 1	600
Band 2	1200
Band 3	2300

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Test Steps (if any)

Step	Test Point	UOM	Nominal	Author's	Builder's
1	LO=2 MHz (band 0) - Test pin 2 (FL SEL 1)	V dc	0	100 mV	
2	LO=2 MHz (band 0) - Test pin 14 (FL SEL 0)	V dc	0	100 mV	
3	LO=6 MHz (band 1) - Test pin 2 (FL SEL 1)	V dc	0	100 mV	
4	LO=6 MHz (band 1) - Test pin 14 (FL SEL 0)	V dc	5	4.92	
5	LO=12 MHz (band 2) - Test pin 2 (FL SEL 1)	V dc	5	4.92	
6	LO=12 MHz (band 2) - Test pin 14 (FL SEL 0)	V dc	0	100 mV	
7	LO=24 MHz (band 3) - Test pin 2 (FL SEL 1)	V dc	5	4.92	
8	LO=24 MHz (band 3) - Test pin 14 (FL SEL 0)	V dc	5	4.92	

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Auto Band Pass Filters - (Optional) RF Test

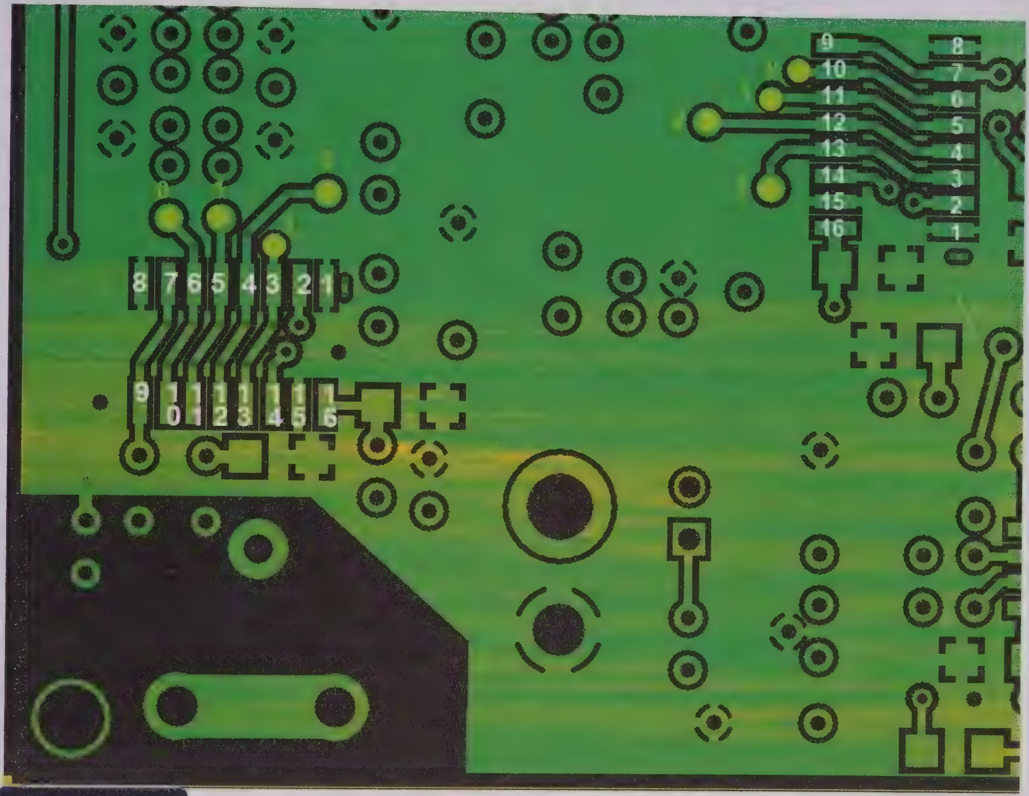
If you have a scope and a signal source (or an RF probe and a signal source)

Inject an RF signal of around 50-100 mV at the antenna jack, determine which band should switch for that RF signal, and probe the pins of U8 and U9 which should be switched to that signal:

Band	Switched Pins
Band 0 (1-4 MHz)	6 & 10
Band 1 (4-8 MHz)	5 & 11
Band 2 (8-16 MHz)	4 & 12
Band 3 (16-30 MHz)	3 & 13

Adjust the frequencies above if you are building the LF kit

Your scope should show the signal at the switched pins and not at any of the other pins.



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Test Steps (if any)

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Next Stage: Mixers

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Test Steps (if any)

Step	Test Point	UOM	Nominal	Author's	Builder's
1	LO=2 MHz (band 0) - Test pin 2 (FL SEL 1)	V dc	0	100 mV	
2	LO=2 MHz (band 0) - Test pin 14 (FL SEL 0)	V dc	0	100 mV	
3	LO=6 MHz (band 1) - Test pin 2 (FL SEL 1)	V dc	0	100 mV	
4	LO=6 MHz (band 1) - Test pin 14 (FL SEL 0)	V dc	5	4.92	
5	LO=12 MHz (band 2) - Test pin 2 (FL SEL 1)	V dc	5	4.92	
6	LO=12 MHz (band 2) - Test pin 14 (FL SEL 0)	V dc	0	100 mV	
7	LO=24 MHz (band 3) - Test pin 2 (FL SEL 1)	V dc	5	4.92	
8	LO=24 MHz (band 3) - Test pin 14 (FL SEL 0)	V dc	5	4.92	

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Auto Band Pass Filters - (Optional) RF Test

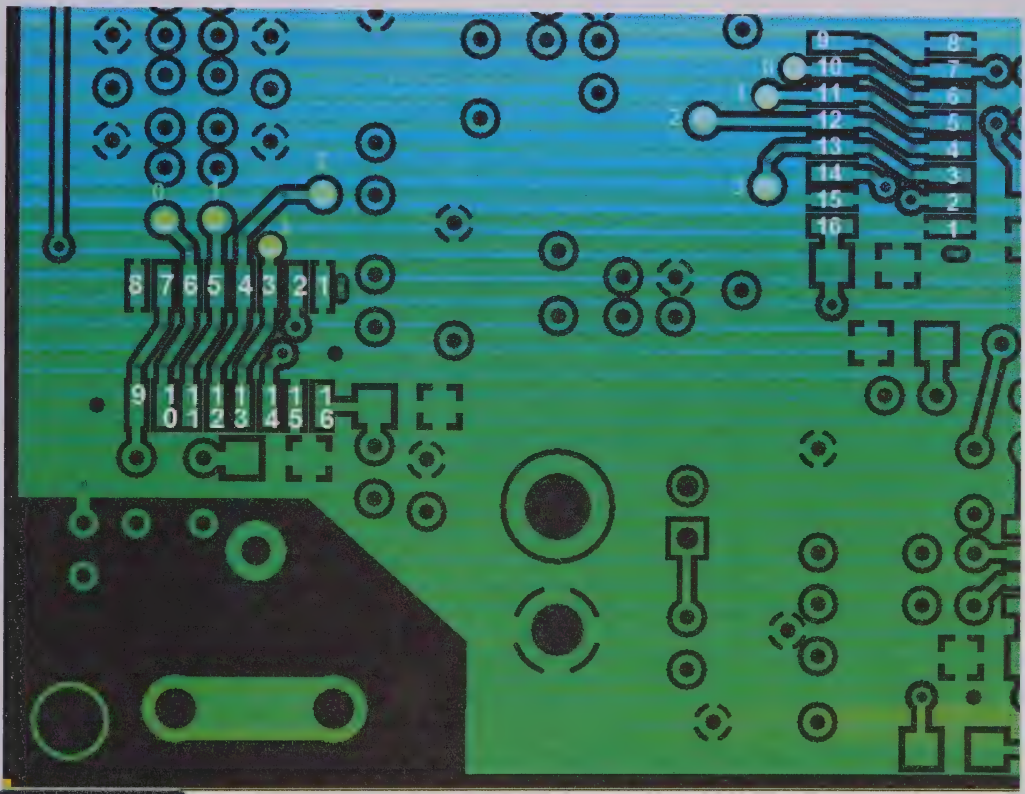
If you have a scope and a signal source (or an RF probe and a signal source)

Inject an RF signal of around 50-100 mV at the antenna jack, determine which band should switch for that RF signal, and probe the pins of U8 and U9 which should be switched to that signal:

Band	Switched Pins
Band 0 (1-4 MHz)	6 & 10
Band 1 (4-8 MHz)	5 & 11
Band 2 (8-16 MHz)	4 & 12
Band 3 (16-30 MHz)	3 & 13

Adjust the frequencies above if you are building the LF kit

Your scope should show the signal at the switched pins and not at any of the other pins.



Go to Top of Page

Test Steps (if any)

Go to Top of Page

Next Stage: Mixers

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WB5RVZ.Org - Ensemble HF/LF RX II

Home Bands Power Supply USB Power LO Dividers BPFs QSD Op Amps
BOM BOM X-Ref Inventory Revisions WB5RVZ

Ensemble RX II (HF/LF) Quadrature Sampling Detector Band: HF

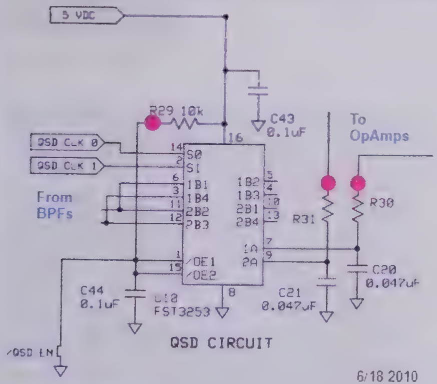
Introduction

Band Specific Components

This stage involves band-specific components and is currently configured for the HF band. If you need to configure this page for a different band, click on the "Band" tab in the menu above. This would take you to the home page, where you can select the new band and then return to this page.

General Info About the Stage

Stage Schematic

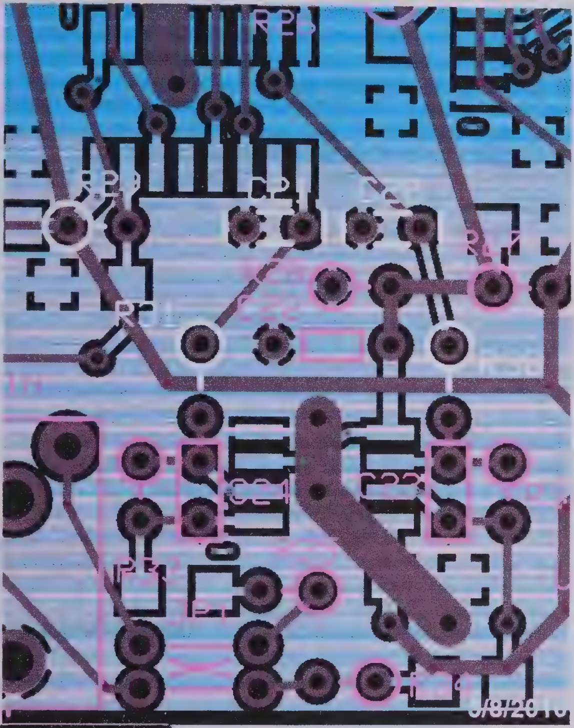


Go to Top of Page

Click here for full schematic

Board Layouts

Board Top



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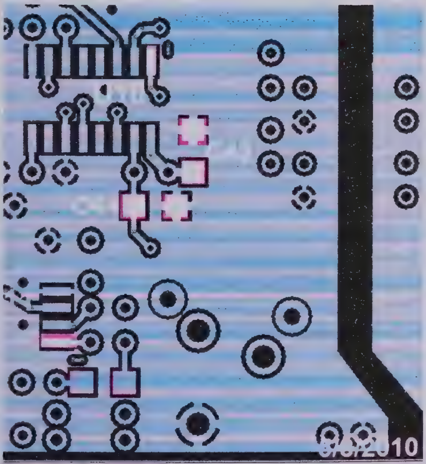
Board Bottom



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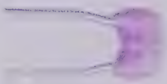
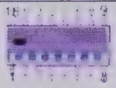
Summary Build Notes

1. Install Bottomside Components

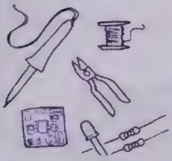
2. Install Topside Components
3. Test the Stage

Quadrature Sampling Detector Bill of Materials (HF band option)

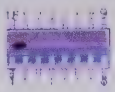
Check	Type	Category	Component	Count	Marking	Image
☐	Capacitor	Ceramic	0.047 uF 5%	2	473	
☐	Capacitor	SMT 1206	0.1 uF	2	(smt) black stripe	
☐	IC	SOIC-16	FST3253 mux/demux switch	1	FST3253 ESD!!!	
☐	Resistor	1/4W	10 ohm 1/4W 1%	2	br-blk-blk-gld-br	
☐	Resistor	1/6W	10 k 1/6W 5%	1	brn-blk-ora-gld	

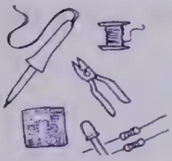
Go to Top of Page

Detailed Build Steps



Install Bottomside Components

Check	Designation	Component (top/bottom)	Orientation	Marking	Image	Band	Notes
☐	C43	0.1 uF ((bottom))	white pads	(smt) black stripe		any	
☐	C44	0.1 uF ((bottom))	white pads	(smt) black stripe		any	
☐	U10	FST3253 mux/demux switch ((bottom))		FST3253 ESD!!!		any	Take extreme care working with this component. Always use ESD precautions.



Install Topside Components

Next Stage: Op Amps

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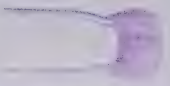
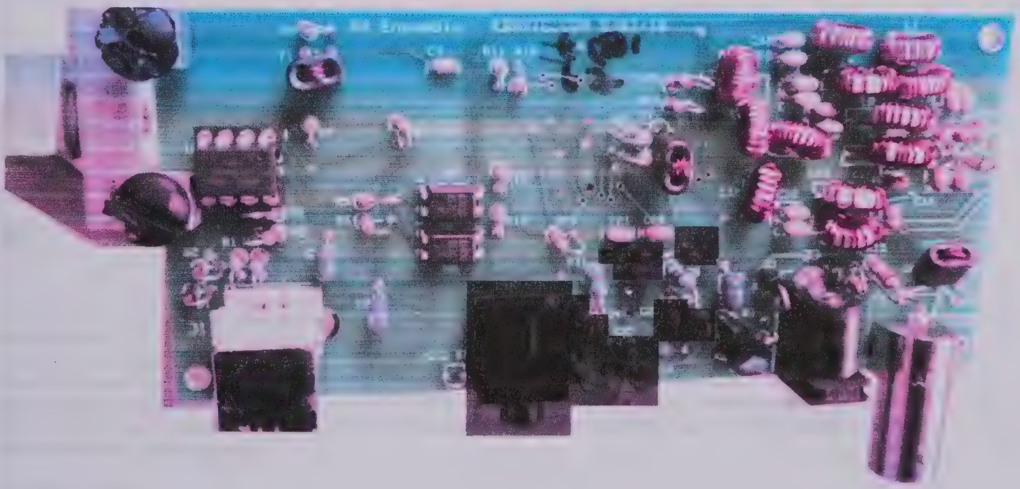
Note: the circuit calls for a jumper for the "QSD EN" (QSD Enable) connection. This was installed during the build of the Power Supply to serve as a convenient ground point for testing in subsequent stages. The purpose of the jumper is to enable RX.

Should you have a situation where you would need to disable RX (e.g., while transmitting on a separate TX device), the jumper can be replaced with appropriate switching mechanisms. For RX only, retain the jumper as installed in the Power Supply stage.

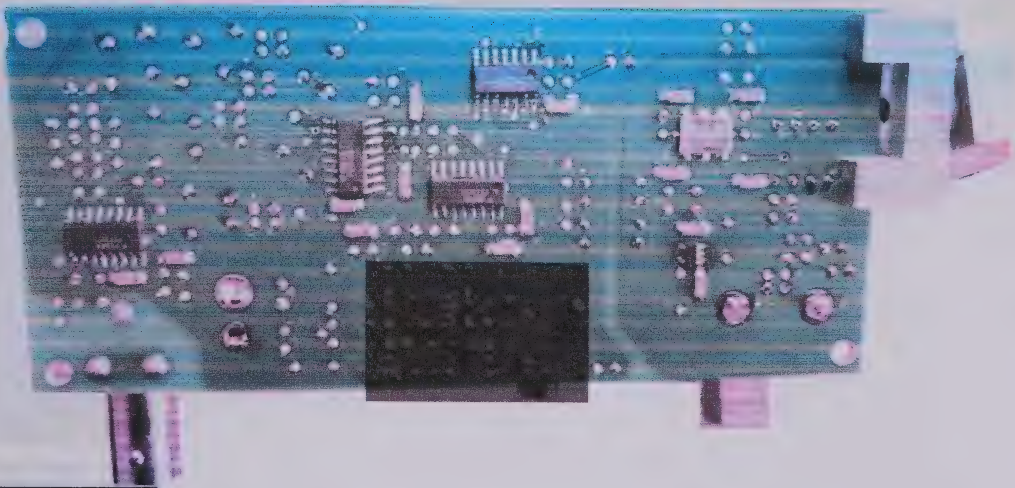
Check	Designation	Component (top/bottom)	Orientation	Marking	Image	Band	Notes
☐	C20	0.047 uF 5% (top)	horiz	473		any	
☐	C21	0.047 uF 5% (top)	horiz	473		any	
☐	R29	10 k 1/6W 5% (top)	W-E	brn-blk-ora-gld		any	was R27
☐	R30	10 ohm 1/4W 1% (top)	N-S	br-blk-blk-gld-br		HF	
☐	R31	10 ohm 1/4W 1% (top)	N-S	br-blk-blk-gld-br		HF	

Completed Photos

View of Completed Topside



View of Completed Underside



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Test the Quadrature Sampling Detector Stage

Quadrature Sampling Detector - IC Pin Voltages

Test Notes

⚠ It has been observed before that some digital meters are affected by the square wave signals on IC pins and do not always read correctly. The readings you get should approximate 2.5V. The best instrument may be a good oscilloscope. Just be prepared to see slightly different readings on pins 10-13 and 3-6, depending on your DMM (mine is not the best!)

⚠ Be sure you have installed the jumper at /QSD EN (back in the Power Supplt stage). This grounds pin 15, enabling the QSD.

Just for a little background information, most of the voltages on U10 pins are derived from the potential divider formed by R27/28 (tested in the Auto Bandpass Filter Stage). If in doubt you can always measure the junction of those two and should get 2.5v as they are equal values across the 5v rail. If one or both were the wrong value, that point would be significantly different. The 2.5v is passed through T3 to the input pins of the multiplexer. and appear on the output pins when the appropriate switch is enabled. Other pins have clock waveforms present, which are relying on the averaging effects of the measuring instrument to give an approximate reading of 2.5v, but this can vary tremendously.

Conduct the Test

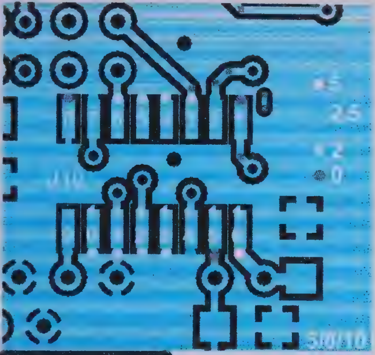
Power the board, connect USB to PC

Voltages are measured WRT (regular) ground (/QSD EN shunt)

Bob G8VOI provided thius note concerning these voltages:

Measure pin voltages

It is best to test for these voltages at the actual pins (not the pads), thereby ensuring correct soldering of the pins to the pads.



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Test Steps (if any)

Step	Test Point	UOM	Nominal	Author's	Builder's
1	Pins 1 and 15 (gnd)	V dc	0	0	
2	Pins 10, 11, 12, and 13 (40% of 5V rail)	V dc	2.5	2.1	
3	Pins 3, 4, 5, and 6 (40% of 5V rail)	V dc	2.5	2.1	
4	Pins 7 and 9 (1/2 of 5V rail)	V dc	2.5	2.5	
5	Pins 2 and 14 (1/2 of 5V rail)	V dc	2.5	2.5	
6	Pin 8 (gnd - /QSD EN, installed in Power Supply Stage)	V dc	0	0	
7	Pin 16 (5 V rail)	V dc	5	5	

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Quadrature Sampling Detector - (Optional) QSD Output Test

Power up the board and connect the USB cable

Run CFGSR.exe and dial in a desired center frequency

Inject an RF signal at approximately 10 kHz below the dialed in center frequency

Probe the hairpin leads of R30 and R31 with your dual channel scope

Depending upon your scope's sensitivity, you should see two 10 kHz signals in quadrature.

As you vary the injected signal to move it above the center frequency, you should see the quadrature signals change frequency and, at crossover, switch the leading and lagging positions.

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Test Steps (if any)

Go to Top of Page

V 5RVZ.Org - Ensemble HF/LF RX II

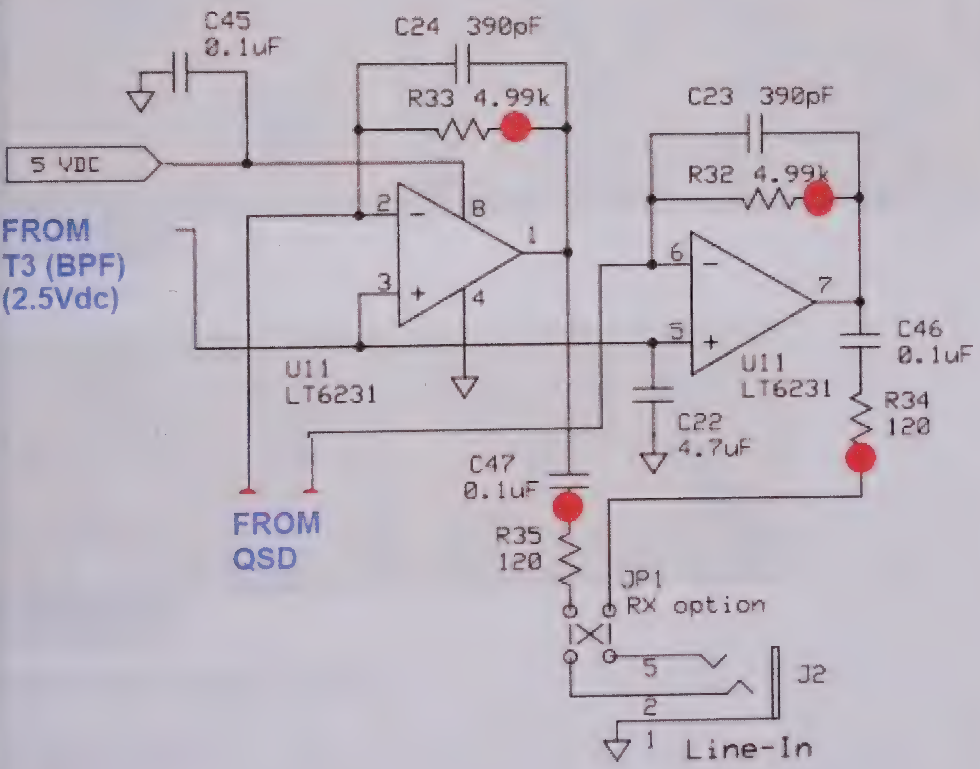
Home Bands Power Supply USB Power LO Dividers BPFs QSD Op Amps BOM BOM X-Ref Inventory Revisions WB5RVZ

nsemble RX II (HF/LF) Operational Amplifiers
and: HF

ntroduction

heory of Operation

tage Schematic



6/18/2010

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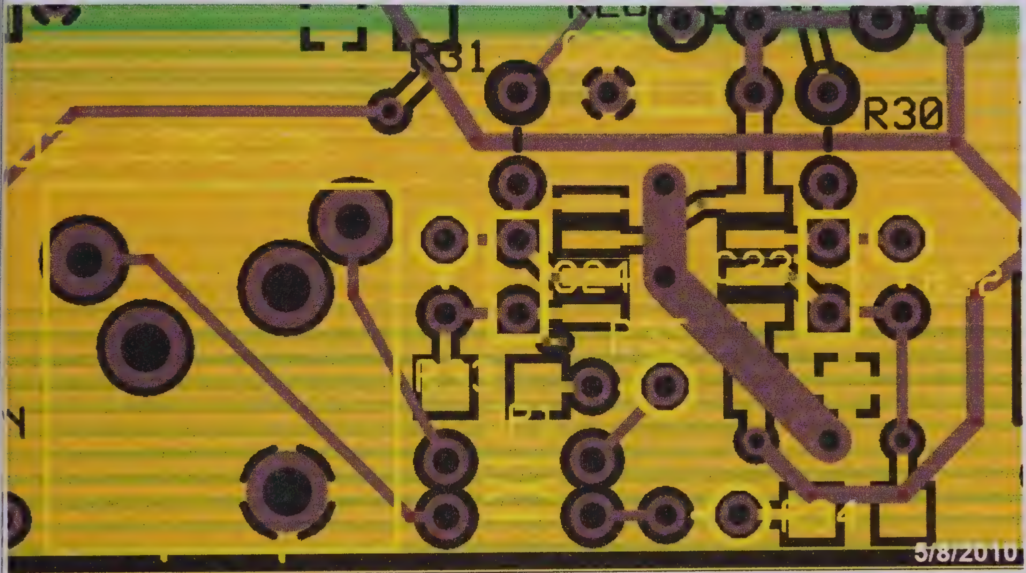
lick here for full schematic

Board Layouts

Board Top



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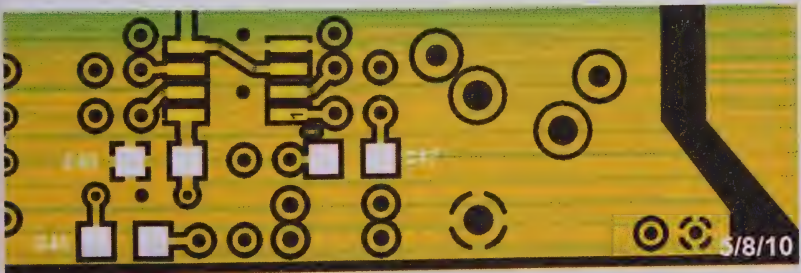
Board Bottom



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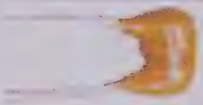
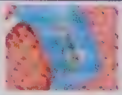
Summary Build Notes

1. Install Bottomside Parts
2. Install Topside Parts
3. Test the Stage

Operational Amplifiers Bill of Materials (HF band option)

Check	Type	Category	Component	Count	Marking	Image
☐	Capacitor	Ceramic	390 pF 5%	2	391	
☐	Capacitor	SMT 1206	0.1 uF	3	(smt) black stripe	
☐	Capacitor	Ceramic	4.7 uF 10% 16V X7R RAD	1	475	
☐	connector	Jack-RA	3.5mm stereo jack - PCB mount (rt-angle)	1		
☐	IC	SOIC-8	LT6231 dual op-amp	1	LT6231 ESD!!!	
☐	Resistor	1/6W	120 1/6W 5%	2	brn-red-brn-gld	
☐	Resistor	1/4W	4.99 k 1/4W 1%	2	y-w-w-br-br	
☐	wire	Cutoff	shunt wire (cut-off lead)	2		

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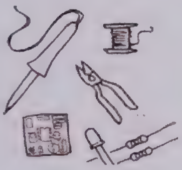
Detailed Build Steps

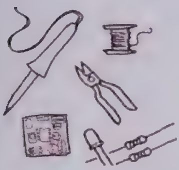


Install Bottomside Parts

Install Bottomside Parts

Check	Designation	Component (top/bottom)	Orientation	Marking	Image	Band	Notes
☐	U11	LT6231 dual op-amp ((bottom))	(or LT6221)	LT6231 ESD!!!		any	
☐	C45	0.1 uF ((bottom))	white pads	(smt) black stripe		any	

☐	C46	0.1 uF ((bottom))	white pads	(smt) black stripe		any	
☐	C47	0.1 uF ((bottom))	white pads	(smt) black stripe		any	

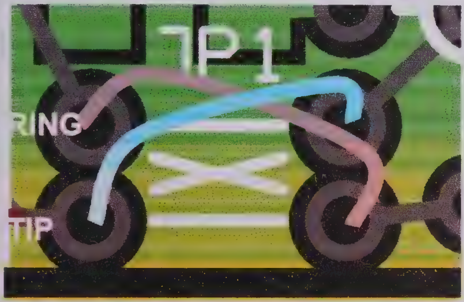


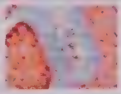
Install Topside Parts

⚠ Careful - there are 1/6W and 1/4W resistors in this step.

install jumpers crosswise rather than straight

"X" pattern), rather than straight (in the parallel pattern), using insulated hookup wire to avoid shorts. This will make the receiver adaptable to all currently published SDR software. While the outputs would appear reversed to Rocky and Winrad, those two programs have a programmatic "switch I and Q lines" setting that can compensate. The PSDR versions do not have such a setting.

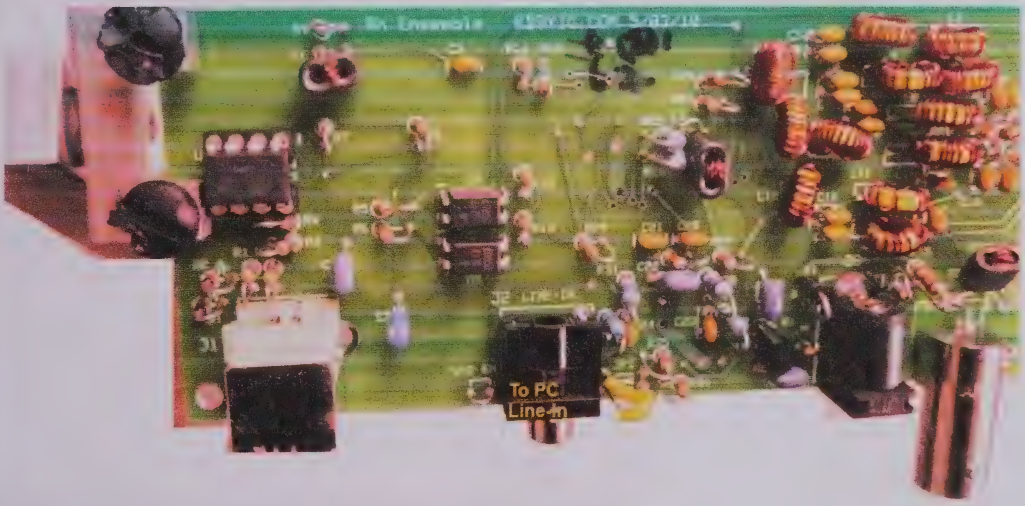


Check	Designation	Component (top/bottom)	Orientation	Marking	Image	Band	Notes
☐	C22	4.7 uF 10% 16V X7R RAD (top)	horiz	475		any	
☐	C24	390 pF 5% (top)	vert	391		any	
☐	C23	390 pF 5% (top)	vert	391		any	
☐	R32	4.99 k 1/4W 1% (top)	N-S	y-w-w-br-br		any	⚠

☐	R33	4.99 k 1/4W 1% (top)	N-S	y-w-w-br-br		any	⚠
☐	R34	120 1/6W 5% (top)	E-W	brn-red-brn-gld		any	
☐	R35	120 1/6W 5% (top)	E-W	brn-red-brn-gld		any	
☐	JP1A	shunt wire (cut-off lead) (top)				any	
☐	JP1B	shunt wire (cut-off lead) (top)				any	
☐	J02	3.5mm stereo jack - PCB mount (rt-angle) (top)				any	

Completed Photos

View of Completed Topside



View of Completed Underside

A personal note ...

LF 9/22/14

Band	freq	noise	sens	
0	455	-135	-120	0.3µV
1	650	-135	-110	0.3µV
2	850	-135	-115	0.3µV
3	2.0	-135	-120	0.3µV

LF

Changes from HF

from LO → OP AMPS

stages (LO - Install T1 and BPF - Install T2) to show the changes to the board layout.

The other changes have to do with the use of 27 gauge vs #30 gauge wire in certain of the coils L1-L12 in the BPF stage. New winding instructions are now reflected on the relevant BOMs.

de robby wb5rvz

Introduction

General Info

The Ensemble RX LF/HF kit and its 4.5: X 2" board representing the culmination of a long line of Softrock SDR receivers from FiveDash, Inc. (Tony Parks, KB9YIG). The line began with the Softrock 40 RX and went through several iterations of receivers. The most recent receiver was the All-band HF receiver with anautomatically switched bandpass filter. This current kit is a refinement on that kit and further streamlines the kitting process for Tony Parks, the designer and supplier.

This kit is for the LF band. You cah switch between the HF and LF band options via the "Band" tab in the menu at the top of this (and each) page.

LF Option

The Ensemble RX LF/HF kit provides the option of coverage of LF frequencies from approximately 160-10m, in four different optional "super bands" (each with underlap and overlap within the parameters of the associated bandpass filter):

1. Band 0: 1000m - Continuous coverage from 180 kHz to 480 kHz
2. Band 1: 500m - Continuous coverage from 400 kHz to 800 kHz
3. Band 2: 250m - Continuous coverage from 800 kHz to 1.6 MHz

Register Login

Home Bands Power Supply USB Power LO

Dividers BPFs OSD Op Amps BOM BOM X-Ref

Inventory Revisions as of 6/20/2013 WB5RVZ

Ensemble RX II (HF/LF) Home - Band: LF

Announcement - Official Site

This site is now the officially maintained site for the Ensemble RX II kit. The previous documentation on www.wb5rvz.com is no longer being maintained. If you are curious, you can still navigate to the previous site to see the original documentation, but be advised that it is no longer being maintained there.

Design Change and New PCB Layout

FiveDash have announced a new board and associated changes to schematics and Bils of Material. Please see the Yahoo softrock40 reflector message #[illegible] for details. If your board is dated 6/20/13, you will need to refer to that message to identify changes to these notes. I have updated the affected steps in the affected

stages (LO - Install T1 and BPF - Install T2) to show the changes to the board layout.

The other changes have to do with the use of 27 gauge vs #30 gauge wire in certain of the coils L1-L12 in the BPF stage. New winding instructions are now reflected on the relevant BOMs.

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1. Band 0: 1000m - Continuous coverage from 180 kHz to 480 kHz
2. Band 1: 500m - Continuous coverage from 400 kHz to 800 kHz
3. Band 2: 250m - Continuous coverage from 800 kHz to 1.6 MHz

4. Band 3: 160m - Continuous coverage from 1.6 MHz to 3.0 MHz

The band coverage is via 4 switchable "bands" ("superbands"). Band switching is performed under program control, in conjunction with programmatic control of the receive frequency. This control is provided by an Atmel ATTiny85 micro-controller, acting as a USB device to control the Si570 programmable oscillator and automatically switch to the appropriate band (0-3) as the frequency changes.

As a welcome improvement over other models, this kit provides pcb-right-angle jacks for all external connections: Antenna, USB from the PC, I/Q output to the PC, and Power to the Board. Thus, once built, the kit can be placed in a suitable enclosure and handled thereafter as a "blackbox peripheral" to the PC.

The design of the Ensemble RX is very similar to the receiver design of its sibling Ensemble RXTX. The major difference is the greater band coverage of the Ensemble RX kit (roughly 4 "superbands" on the RX vs. 1 "superband" on the RXTX).

This kit is an excellent value for both the licensed amateur and the SWL who is comfortable with building electronics kits. The skill level and experience requirements are medium-level because of the small size of the components, the requirement to be able to solder SMT parts, and the requirement to wind and install inductors. Thousands of builders have proven this is not an insurmountable set of requirements. If you are new at this, you should try one of Tony's sub $20 monobander RX kits as a "starter/learner" kit.

Several hams have provided interesting/informative galleries of photos as they have followed these build notes:

- Ulf K1ULF

Recommended Enclosure

Tom KM5KH offers a very nice enclosure for the Ensemble RX line.

Theory of Operaton

4. Band 3: 160m - Continuous coverage from 1.6 MHz to 3.0 MHz

The band coverage is via 4 switchable "bands" ("superbands"). Band switching is performed under program control, in conjunction with programmatic control of the receive frequency. This control is provided by an Atmel ATTiny85 micro-controller, acting as a USB device to control the Si570 programmable oscillator and automatically switch to the appropriate band (0-3) as the frequency changes.

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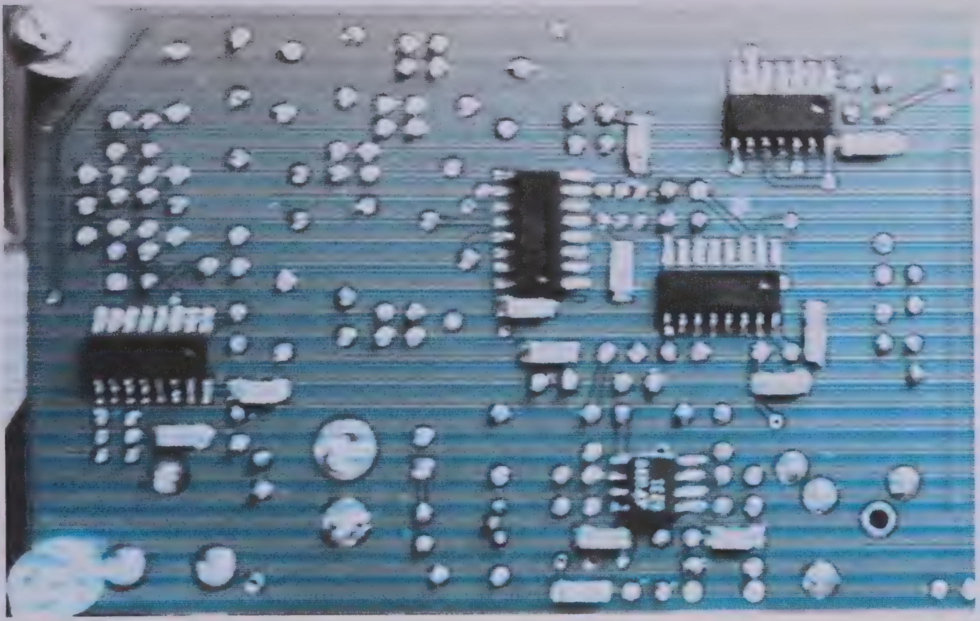


Background Info

Tools

Winding Inductors

This page has the following inductors:

1. L01

   COIL: 55uH: 117T #30(61in) on T37-2(red)
   Using approximately 61 inches of #30 wire, wind 117 turns on a 0.37 inch od T37-2(red) ferrite. Inductance = 55.00 uH.

2. L02

   COIL: 26uH: 80T #30(43in) on T37-2(red)
   Using approximately 43 inches of #30 wire, wind 80 turns on a 0.37 inch od T37-2(red) ferrite. Inductance = 26.00 uH.

3. L03

   COIL: 55uH: 117T #30(61in) on T37-2(red)
   Using approximately 61 inches of #30 wire, wind 117 turns on a 0.37 inch od T37-2(red) ferrite. Inductance = 55.00 uH.

4. L04

   COIL: 20uH: 68T #30(36in) on T30-2(red)
   Using approximately 36 inches of #30 wire, wind 68 turns on a 0.30 inch od T30-2(red) ferrite. Inductance = 20.00 uH.

5. L05

   COIL: 4.6uH: 32T #27(18in) on T30-2(red)
   Using approximately 19 inches of 27 wire, wind 32 turns on a 0.30 inch od T30-2(red) ferrite. Inductance = 4.60 uH.

6. L06

   COIL: 20uH: 68T #30(36in) on T30-2(red)
   Using approximately 36 inches of #30 wire, wind 68 turns on a 0.30 inch od T30-2(red) ferrite. Inductance = 20.00 uH.

7. L07

   COIL: 10uH: 48T #27(26in) on T30-2(red)
   Using approximately 27 inches of #27 wire, wind 48 turns on a 0.30 inch od T30-2(red) ferrite. Inductance = 10.00 uH.

8. L08

   COIL: 2.7uH: 25T #27(15in) on T30-2(red)
   Using approximately 16 inches of #27 wire, wind 25 turns on a 0.30 inch od T30-2(red) ferrite. Inductance = 2.70 uH.

9. L09

   COIL: 10uH: 48T #27(26in) on T30-2(red)
   Using approximately 27 inches of #27 wire, wind 48 turns on a 0.30 inch od T30-2(red) ferrite. Inductance = 10.00 uH.

10. L10

    COIL: 4.6uH: 32T #27(18in) on T30-2(red)
    Using approximately 19 inches of 27 wire, wind 32 turns on a 0.30 inch od T30-2(red) ferrite. Inductance = 4.60 uH.

11. L11

    COIL: 1.3uH: 17T #27(11in) on T30-2(red)
    Using approximately 12 inches of #27 wire, wind 17 turns on a 0.30 inch od T30-2(red) ferrite. Inductance = 1.30 uH.

12. L12

    COIL: 4.6uH: 32T #27(18in) on T30-2(red)
    Using approximately 19 inches of 27 wire, wind 32 turns on a 0.30 inch od T30-2(red) ferrite. Inductance = 4.60 uH.

13. T01

    XFRMR: 12.96uH: 3T(bi)T #30(10 (2x5)in) on BN43-2402
    Using a total of approximately 9 inches of #30 wire, wind 3 turns , bifilar, on a BN-43-2402 ferrite.Inductance of the single winding (usually the primary) is 12.96 uH.

14. T02

    XFRMR: 70.56uH: 7T(bi)T #30(16 (2x8)in) on BN43-2402
    Using a total of approximately 15 inches of #30 wire, wind 7 turns , bifilar, on a BN-43-2402 ferrite.Inductance of the single winding (usually the primary) is 70.56 uH.

15. T03

    XFRMR: 70.56uH: 7T/3T(bi)T #30(18 (8/2x5)in) on BN43-2402
    Primary: Using approximately 9 inches of #30 wire, wind 7 turns on a BN-43-2402 ferrite.
    Secondary: Using a total of 9 inches of #30 wire, wind 3 turns , bifilar, on the ferrite in the same direction as the primary winding. Inductance of the single winding (usually the primary) is 70.56 uH.

To learn how to wind coils and transformers, please read the

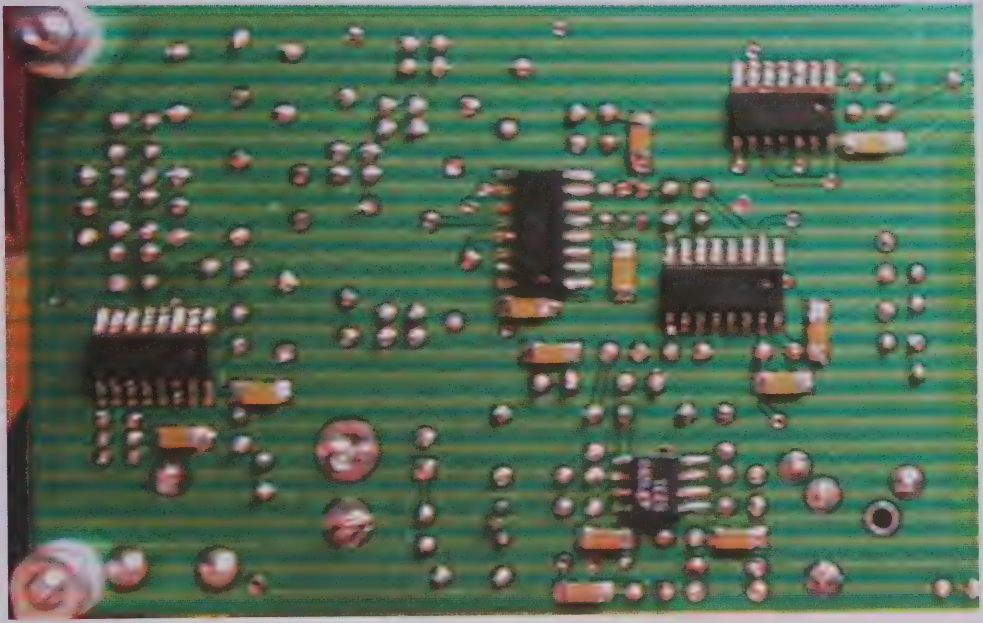
- [illegible] and then
- view the excellent videos on
- or take a read of
- You can review the for details on deciphering the winding specifications, core specifications,and construction of toroidal and binocular inductors.

Component Identification

After soldering problems, the most common cause of trouble in kit building is the installation of the incorrect component. Most often this is the case with resistors (hint - if voltage or current draw tests are way out of whack, suspect resistors or solder bridges). Invest in a cheap multimeter and MEASURE the resistance. As Pete, M0FMT, said: " ... then you don't have to worry about this modern trend of poor identification of components. I doubt you will find an issue with Tony's kits but measuring is best. A cheap OVA meter costs 2 or 3 bucks and a simple cap bridge is easy to build. (you can search E-Bay for "L/C/F Inductance Capacitance High Precision Meter" and will find several digital L/C meters for $20-$30) These two bits of kit are worth there wieght in gold. Oh and most meters have diode and transistor testers build in... remarkable when you think back to the darkages when I were a lad."

Soldering

If you are not experienced at soldering (and even if you are somewhat experienced at soldering), refer to



Background Info

Tools

Winding Inductors

This page has the following inductors:

1. L01

   COIL: 55uH: 117T #30(61in) on T37-2(red)
   Using approximately 61 inches of #30 wire, wind 117 turns on a 0.37 inch od T37-2(red) ferrite. Inductance = 55.00 uH.

2. L02

   COIL: 26uH: 80T #30(43in) on T37-2(red)
   Using approximately 43 inches of #30 wire, wind 80 turns on a 0.37 inch od T37-2(red) ferrite. Inductance = 26.00 uH.

3. L03

   COIL: 55uH: 117T #30(61in) on T37-2(red)
   Using approximately 61 inches of #30 wire, wind 117 turns on a 0.37 inch od T37-2(red) ferrite. Inductance = 55.00 uH.

4. L04

   COIL: 20uH: 68T #30(36in) on T30-2(red)
   Using approximately 36 inches of #30 wire, wind 68 turns on a 0.30 inch od T30-2(red) ferrite. Inductance = 20.00 uH.

5. L05

   COIL: 4.6uH: 32T #27(18in) on T30-2(red)
   Using approximately 19 inches of 27 wire, wind 32 turns on a 0.30 inch od T30-2(red) ferrite. Inductance = 4.60 uH.

6. L06

   COIL: 20uH: 68T #30(36in) on T30-2(red)
   Using approximately 36 inches of #30 wire, wind 68 turns on a 0.30 inch od T30-2(red) ferrite. Inductance = 20.00 uH.

7. L07

   COIL: 10uH: 48T #27(26in) on T30-2(red)
   Using approximately 27 inches of #27 wire, wind 48 turns on a 0.30 inch od T30-2(red) ferrite. Inductance = 10.00 uH.

8. L08

   COIL: 2.7uH: 25T #27(15in) on T30-2(red)
   Using approximately 16 inches of #27 wire, wind 25 turns on a 0.30 inch od T30-2(red) ferrite. Inductance = 2.70 uH.

9. L09

   COIL: 10uH: 48T #27(26in) on T30-2(red)
   Using approximately 27 inches of #27 wire, wind 48 turns on a 0.30 inch od T30-2(red) ferrite. Inductance = 10.00 uH.

10. L10

    COIL: 4.6uH: 32T #27(18in) on T30-2(red)
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11. L11

    COIL: 1.3uH: 17T #27(11in) on T30-2(red)
    Using approximately 12 inches of #27 wire, wind 17 turns on a 0.30 inch od T30-2(red) ferrite. Inductance = 1.30 uH.

12. L12

    COIL: 4.6uH: 32T #27(18in) on T30-2(red)
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13. T01

    XFRMR: 12.96uH: 3T(bi)T #30(10 (2x5)in) on BN43-2402
    Using a total of approximately 9 inches of #30 wire, wind 3 turns , bifilar, on a BN-43-2402 ferrite.Inductance of the single winding (usually the primary) is 12.96 uH.

14. T02

    XFRMR: 70.56uH: 7T(bi)T #30(16 (2x8)in) on BN43-2402
    Using a total of approximately 15 inches of #30 wire, wind 7 turns , bifilar, on a BN-43-2402 ferrite.Inductance of the single winding (usually the primary) is 70.56 uH.

15. T03

    XFRMR: 70.56uH: 7T/3T(bi)T #30(18 (8/2x5)in) on BN43-2402
    Primary: Using approximately 9 inches of #30 wire, wind 7 turns on a BN-43-2402 ferrite.
    Secondary: Using a total of 9 inches of #30 wire, wind 3 turns , bifilar, on the ferrite in the same direction as the primary winding. Inductance of the single winding (usually the primary) is 70.56 uH.

To learn how to wind coils and transformers, please read the

- tips from the experts and then
- view the excellent videos on KC0WOXs Website
- or take a read of Dinesh's VU2FD guidelines.
- You can review the common construction techniques for inductors for details on deciphering the winding specifications, core specifications,and construction of toroidal and binocular inductors.

Component Identification

After soldering problems, the most common cause of trouble in kit building is the installation of the incorrect component. Most often this is the case with resistors (hint - if voltage or current draw tests are way out of whack, suspect resistors or solder bridges). Invest in a cheap multimeter and MEASURE the resistance. As Pete, M0FMT, said: " ... then you don't have to worry about this modern trend of poor identification of components. I doubt you will find an issue with Tony's kits but measuring is best. A cheap OVA meter costs 2 or 3 bucks and a simple cap bridge is easy to build. (you can search E-Bay for "L/C/F Inductance Capacitance High Precision Meter" and will find several digital L/C meters for $20-$30) These two bits of kit are worth there wieght in gold. Oh and most meters have diode and transistor testers build in... remarkable when you think back to the darkages when I were a lad."

It cannot be overstressed: do not rely solely on the color codes for identification of the correct resistor; ALWAYS measure with your ohmmeter as a double check. Measure twice, cut once.

Soldering

If you are not experienced at soldering (and even if you are somewhat experienced at soldering), refer to Tom N0SS's excellent tutorial on basic soldering techniques.

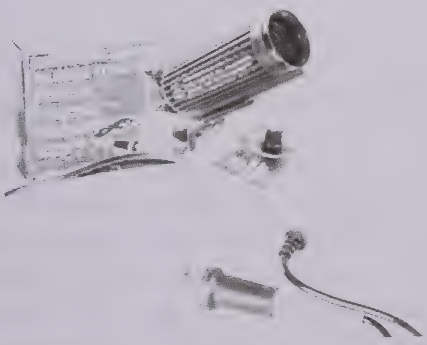
The video below describes techniques for soldering SOIC 14 (and 16 and 8) SMDs

"

You may also want to review the information from the HamNation series on George, W5JDX, and his build of the Softrock Ensemble RXTX. He uses an inexpensive heat gun and Solder paste to install SMT capacitors and ICs. The Session where he introduces the process is in at 36 minutes, 30 seconds into the podcast.

For the more adventurous, there is a process using solder paste and an electric oven called the reflow process, which can be used to install all the SMT chips to one side of the PC Board. This is documented by Guenael Jouchet in the following Youtube segment:

- Read the [illegible] at the Sparkfun site. It is a very good read and it speaks great truths. Then take the time to watch the [illegible].
- Solder Stations. Don't skimp here. Soldering deficiencies account for 80 percent of the problems surfaced in troubleshooting. It is preferable to have an ESD-safe station, with a grounded tip. A couple of good stations that are relatively inexpensive are:



  - Velleman [illegible] (approx $25 at Frys) ([illegible])

- ○ Haakko 936

ESD Protection

You may wish to review the message topic beginning at
for a common-sense discussion on ESD.

- Avoid carpets in cool, dry areas.
- Leave PC cards and memory modules in their anti-static packaging until ready to be installed.
- Dissipate static electricity before handling any system components (PC cards, memory modules) by touching a grounded metal object, such as the system unit unpainted metal chassis.
- If possible, use antistatic devices, such as (see for $25 or the for $15)).
- Always hold a PC card or memory module by its edges. Avoid touching the contacts and components on the memory module.

- Before removing chips from insulator, put on the wrist strap connected to the ESD mat. All work with CMOS chips should be done with the wrist strap on.
- As an added precaution before first touching a chip, you should touch a finger to a grounded metal surface.
- If using a DMM, its outside should be in contact with the ground of the ESD mat, and both leads shorted to this ground before use.
- See the review of ESD Precautions at this .

Work Area

- You will need a well-lit work area and a minimum of 3X magnification (the author uses a cheap magnifying fluorescent light with a 3X lens. This is supplemented by a hand-held 10 X loupe - with light - for close-in inspection of solder joints and SMT installation.
- You should use a cookie sheet or baking pan (with four sides raised approximately a half an inch) for your actual work space. It is highly recommended for building on top of in order to catch stray parts, especially the tiny SMT chips which, once they are launched by an errant tweezer squeeze, are nigh on impossible to find if they are not caught on the cookie sheet.

Misc Tools

- It is most important to solidly clamp the PCB in a holder when soldering. A "third-hand" (e.g., or the) can hold your board while soldering. In a pinch, you can get by with a simple . Jan G0BBL suggests "A very cheap way is to screw a Large Document Clip to a woodblock which will clamp the side of a PCB."
-
- Tweezers (bent tip is preferable).
- A toothpick and some beeswax - these can be used to pickup SMT devices and hold them steady while soldering.
- Diagonal side cutters.

- Small, rounded jaw needle-nose pliers.
- Set of jewelers' screwdrivers
- An Exacto knife.
- Fine-grit emery paper.

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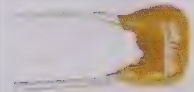
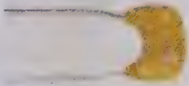
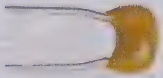
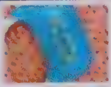
WB5RVZ.Org - Ensemble HF/LF RX II Register Login

Home Bands Power Supply USB Power LO Dividers BPFs QSD Op
Amps BOM BOM X-Ref Inventory Revisions WB5RVZ

Ensemble RX II (HF/LF) Bill of Materials
Band: LF

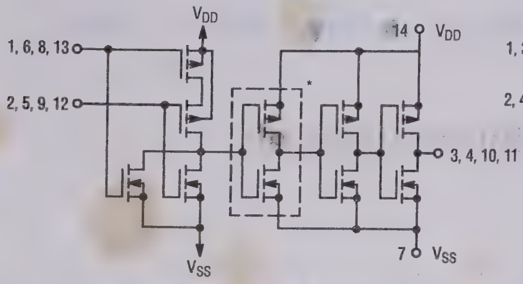
Project Bill of Materials

	Check	Type	Category	Component	Count	Marking	Image
	[ ]	Band-specific	Omit	omit for this band	5		
	[ ]	boardhdw	HDW	4 X #4-40 hdw (nut, bolt, washer, spacer)	1		
	[ ]	Capacitor	Ceramic	0.015 uF 5%	2	153	
5	[ ]	Capacitor	Ceramic	390 pF 5%	2	391	
	[✓]	Capacitor	Ceramic	1000 pF 5%	2	102	
	[✓]	Capacitor	Ceramic	1800 pF 5%	2	182	
	[✓]	Capacitor	Ceramic	3300 pF 5%	3	332	
	[✓]	Capacitor	Ceramic	6800 pF 5%	3	682	
	[✓]	Capacitor	Ceramic	0.01 uF	1	103	
4	[ ]	Capacitor	Ceramic	0.047 uF 5%	2	473	
	[ ]	Capacitor	SMT 1206	0.1 uF	20	(smt) black stripe	
9K	[ ]	Capacitor	Ceramic	4.7 uF 10% 16V X7R RAD	5	475	

2 101
3 481
2 181

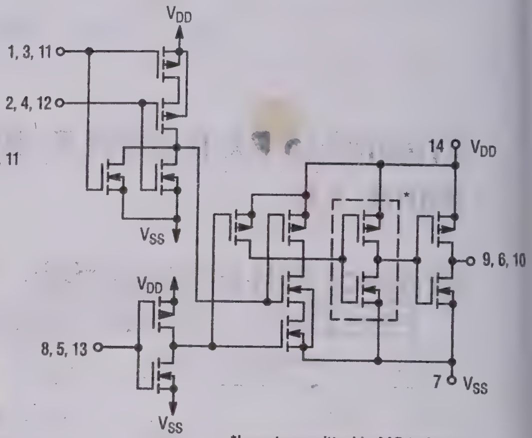
CIRCUIT SCHEMATIC
NOR, OR GATES

MC14001B, MC14071B
One of Four Gates Shown



*Inverter omitted in MC14001B

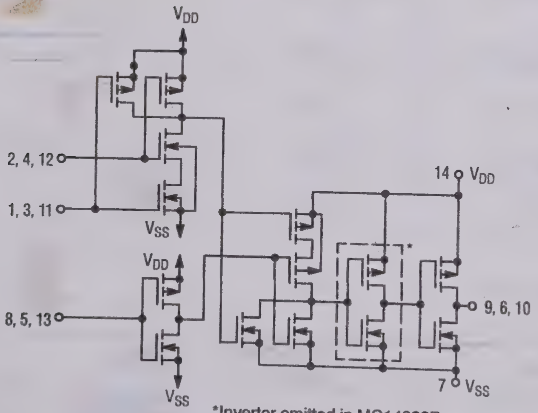
MC14025B
One of Three Gates Shown



*Inverter omitted in MC14025B

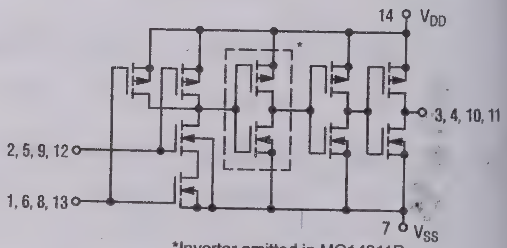
CIRCUIT SCHEMATIC
NAND, AND GATES

MC14023B, MC14073B
One of Three Gates Shown

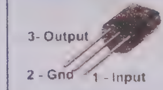
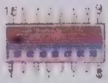
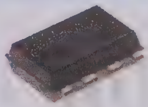
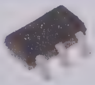


*Inverter omitted in MC14023B

MC14011B, MC14081B
One of Four Gates Shown



*Inverter omitted in MC14011B

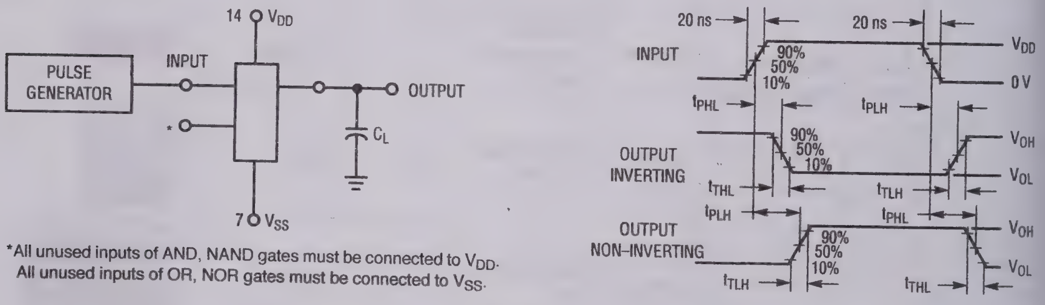
[ ]	connector	Jack	BNC Connector Male - PCB mount	1		
[ ]	connector	Jack-RA	3.5mm stereo jack - PCB mount (rt-angle)	1		
[ ]	Connector	Jack-RA	DC Power Jack PCB Mount (rt-angle) 2.5mm	1		
[ ]	Connector	Plug	DC Power Plug 5.5/2.5mm Pos Ctr	1		
[ ]	connector	Jack-RA	USB-B pcb jack (rt-angle)	1		
[ ]	Diode	Axial	1N4003	1	1N4003	
[ ]	Diode	Axial	BZX55C3V3 3.3V zener diode	2	BZX55C	
[ ]	IC	TO-92	LM78L05 voltage regulator	1	LM78L05	
[ ]	IC	SOIC-16	FST3253 mux/demux switch	3	FST3253	
[ ]	IC	SOIC-8	LT6231 dual op-amp	1	LT6231	
[ ]	IC	SOIC-14	74AC74 Dual D FF	2	74AC74	
[ ]	IC	DIP 8	ATtiny 85-20 PU w/V15.12 Firmware	1	AVR ATTINY85-20PU	
[ ]	IC	DIP-4	LTV-817 Opto-Isolator	2	LTV 817	
[ ]	IC	SOT-23-5	LP2992AIM5-3.3V regulator	1	LFEA	

B–SERIES GATE SWITCHING TIMES

SWITCHING CHARACTERISTICS [6.] (C_L = 50 pF, T_A = 25°C)

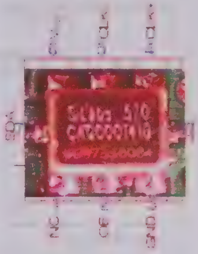
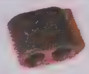
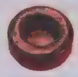
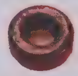
Characteristic	Symbol	V_{DD} Vdc	Min	Typ [7.]	Max	Unit
Output Rise Time, All B–Series Gates	t_{TLH}					ns
t_{TLH} = (1.35 ns/pF) C_L + 33 ns		5.0	—	100	200	
t_{TLH} = (0.60 ns/pF) C_L + 20 ns		10	—	50	100	
t_{TLH} = (0.40 ns/PF) C_L + 20 ns		15	—	40	80	
Output Fall Time, All B–Series Gates	t_{THL}					ns
t_{THL} = (1.35 ns/pF) C_L + 33 ns		5.0	—	100	200	
t_{THL} = (0.60 ns/pF) C_L + 20 ns		10	—	50	100	
t_{THL} = (0.40 ns/pF) C_L + 20 ns		15	—	40	80	
Propagation Delay Time	t_{PLH}, t_{PHL}					ns
MC14001B, MC14011B only						
t_{PLH}, t_{PHL} = (0.90 ns/pF) C_L + 80 ns		5.0	—	125	250	
t_{PLH}, t_{PHL} = (0.36 ns/pF) C_L + 32 ns		10	—	50	100	
t_{PLH}, t_{PHL} = (0.26 ns/pF) C_L + 27 ns		15	—	40	80	
All Other 2, 3, and 4 Input Gates						
t_{PLH}, t_{PHL} = (0.90 ns/pF) C_L + 115 ns		5.0	—	160	300	
t_{PLH}, t_{PHL} = (0.36 ns/pF) C_L + 47 ns		10	—	65	130	
t_{PLH}, t_{PHL} = (0.26 ns/pF) C_L + 37 ns		15	—	50	100	
8–Input Gates (MC14068B, MC14078B)						
t_{PLH}, t_{PHL} = (0.90 ns/pF) C_L + 155 ns		5.0	—	200	350	
t_{PLH}, t_{PHL} = (0.36 ns/pF) C_L + 62 ns		10	—	80	150	
t_{PLH}, t_{PHL} = (0.26 ns/pF) C_L + 47 ns		15	—	60	110	

6. The formulas given are for the typical characteristics only at 25°C.
7. Data labelled "Typ" is not to be used for design purposes but is intended as an indication of the IC's potential performance.



*All unused inputs of AND, NAND gates must be connected to V_{DD}.
All unused inputs of OR, NOR gates must be connected to V_{SS}.

Figure 1. Switching Time Test Circuit and Waveforms

[ ]	IC	I2C	Si570 Programmable Oscillator	1	SiLabs 570	
[ ]	inductor	Binocular core	BN-43-2402 (no markings!)	3	none	
[ ]	inductor	Toroid	T30-2 toroid core	9	red	
[ ]	inductor	Toroid	T37-2 toroid core	3	red	
[ ]	Inductor	coil	1.3uH: 17T #30(11in) on T30-2(red)	1	red	
[ ]	Inductor	coil	2.7uH: 25T #30(15in) on T30-2(red)	1	red	
[ ]	Inductor	coil	4.6uH: 32T #30(18in) on T30-2(red)	3	red	
[ ]	Inductor	coil	10uH: 48T #30(26in) on T30-2(red)	2	red	
[ ]	Inductor	xfrmr	12.96uH: 3T(bi)T #30(10 (2x5)in) on BN43-2402	1		
[ ]	Inductor	coil	20uH: 68T #30(36in) on T30-2(red)	2	red	
[ ]	Inductor	coil	26uH: 80T #30(43in) on T37-2(red)	1	red	
[ ]	Inductor	coil	55uH: 117T #30(61in) on T37-2(red)	2	red	
[ ]	Inductor	xfrmr	70.56uH: 7T(bi)T #30(16 (2x8)in) on BN43-2402	1		
[ ]	Inductor	xfrmr	70.56uH: 7T/3T(bi)T #30(18 (8/2x5)in) on BN43-2402	1		
[ ]	PCB	Main Board	Ensemble RX PCB (board)	1		

ELECTRICAL CHARACTERISTICS (Voltages Referenced to V_{SS})

Characteristic	Symbol	V_{DD} Vdc	−55°C		25°C			125°C		Unit
			Min	Max	Min	Typ [3.]	Max	Min	Max	
Output Voltage "0" Level	V_{OL}	5.0	—	0.05	—	0	0.05	—	0.05	Vdc
V_{in} = V_{DD} or 0		10	—	0.05	—	0	0.05	—	0.05	
		15	—	0.05	—	0	0.05	—	0.05	
"1" Level	V_{OH}	5.0	4.95	—	4.95	5.0	—	4.95	—	Vdc
V_{in} = 0 or V_{DD}		10	9.95	—	9.95	10	—	9.95	—	
		15	14.95	—	14.95	15	—	14.95	—	
Input Voltage "0" Level	V_{IL}									Vdc
(V_O = 4.5 or 0.5 Vdc)		5.0	—	1.5	—	2.25	1.5	—	1.5	
(V_O = 9.0 or 1.0 Vdc)		10	—	3.0	—	4.50	3.0	—	3.0	
(V_O = 13.5 or 1.5 Vdc)		15	—	4.0	—	6.75	4.0	—	4.0	
"1" Level	V_{IH}									Vdc
(V_O = 0.5 or 4.5 Vdc)		5.0	3.5	—	3.5	2.75	—	3.5	—	
(V_O = 1.0 or 9.0 Vdc)		10	7.0	—	7.0	5.50	—	7.0	—	
(V_O = 1.5 or 13.5 Vdc)		15	11	—	11	8.25	—	11	—	
Output Drive Current	I_{OH}									mAdc
(V_{OH} = 2.5 Vdc) Source		5.0	−3.0	—	−2.4	−4.2	—	−1.7	—	
(V_{OH} = 4.6 Vdc)		5.0	−0.64	—	−0.51	−0.88	—	−0.36	—	
(V_{OH} = 9.5 Vdc)		10	−1.6	—	−1.3	−2.25	—	−0.9	—	
(V_{OH} = 13.5 Vdc)		15	−4.2	—	−3.4	−8.8	—	−2.4	—	
(V_{OL} = 0.4 Vdc) Sink	I_{OL}	5.0	0.64	—	0.51	0.88	—	0.36	—	mAdc
(V_{OL} = 0.5 Vdc)		10	1.6	—	1.3	2.25	—	0.9	—	
(V_{OL} = 1.5 Vdc)		15	4.2	—	3.4	8.8	—	2.4	—	
Input Current	I_{in}	15	—	± 0.1	—	±0.00001	± 0.1	—	± 1.0	µAdc
Input Capacitance (V_{in} = 0)	C_{in}	—	—	—	—	5.0	7.5	—	—	pF
Quiescent Current (Per Package)	I_{DD}	5.0	—	0.25	—	0.0005	0.25	—	7.5	µAdc
		10	—	0.5	—	0.0010	0.5	—	15	
		15	—	1.0	—	0.0015	1.0	—	30	
Total Supply Current [4.] [5.] (Dynamic plus Quiescent, Per Gate, C_L = 50 pF)	I_T	5.0	$I_T = (0.3\ \mu A/kHz)\ f + I_{DD}/N$							µAdc
		10	$I_T = (0.6\ \mu A/kHz)\ f + I_{DD}/N$							
		15	$I_T = (0.9\ \mu A/kHz)\ f + I_{DD}/N$							

3. Data labelled "Typ" is not to be used for design purposes but is intended as an indication of the IC's potential performance.
4. The formulas given are for the typical characteristics only at 25°C.
5. To calculate total supply current at loads other than 50 pF:

$$I_T(C_L) = I_T(50\ pF) + (C_L - 50)\ Vfk$$

where: I_T is in µA (per package), C_L in pF, $V = (V_{DD} - V_{SS})$ in volts, f in kHz is input frequency, and k = 0.001 x the number of exercised gates per package.

[ ]	Resistor	1/4W	10 ohm 1/4W 1%	2	br-blk-blk-gld-br	
[ ]	Resistor	1/4W	49.9 ohm 1%	2	yel-wht-wht-gld-brn	
[ ]	Resistor	1/6W	68 1/6W 5%	3	bl-gry-blk-gld	
[ ]	Resistor	1/6W	120 1/6W 5%	2	brn-red-brn-gld	
[ ]	Resistor	1/6W	2.2k 1/6W 5%	12	red-red-red-gld	
[ ]	Resistor	1/4W	4.99 k 1/4W 1%	2	y-w-w-br-br	
[ ]	Resistor	1/6W	10 k 1/6W 5%	5	brn-blk-ora-gld	
[ ]	Resistor	1/6W	1 M 1/6W 5%	1	brn-blk-grn-gld	
[ ]	socket	Socket	8 pin dip socket	1		
[ ]	wire	Cutoff	shunt wire (cut-off lead)	8		
[ ]	wire	Magnetic	Magnetic Wire, enameled #30	6		

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MC14001B Series

B-Suffix Series CMOS Gates

MC14001B, MC14011B, MC14023B, MC14025B, MC14071B, MC14073B, MC14081B, MC14082B

The B Series logic gates are constructed with P and N channel enhancement mode devices in a single monolithic structure (Complementary MOS). Their primary use is where low power dissipation and/or high noise immunity is desired.

- Supply Voltage Range = 3.0 Vdc to 18 Vdc
- All Outputs Buffered
- Capable of Driving Two Low–power TTL Loads or One Low–power Schottky TTL Load Over the Rated Temperature Range.
- Double Diode Protection on All Inputs Except: Triple Diode Protection on MC14011B and MC14081B
- Pin–for–Pin Replacements for Corresponding CD4000 Series B Suffix Devices

MAXIMUM RATINGS (Voltages Referenced to V_{SS}) (Note 1.)

Symbol	Parameter	Value	Unit
V_{DD}	DC Supply Voltage Range	–0.5 to +18.0	V
V_{in}, V_{out}	Input or Output Voltage Range (DC or Transient)	–0.5 to V_{DD} + 0.5	V
I_{in}, I_{out}	Input or Output Current (DC or Transient) per Pin	±10	mA
P_D	Power Dissipation, per Package (Note 2.)	500	mW
T_A	Ambient Temperature Range	–55 to +125	°C
T_{stg}	Storage Temperature Range	–65 to +150	°C
T_L	Lead Temperature (8–Second Soldering)	260	°C

1. Maximum Ratings are those values beyond which damage to the device may occur.
2. Temperature Derating:
   Plastic "P and D/DW" Packages: – 7.0 mW/°C From 65°C To 125°C

This device contains protection circuitry to guard against damage due to high static voltages or electric fields. However, precautions must be taken to avoid applications of any voltage higher than maximum rated voltages to this high–impedance circuit. For proper operation, V_{in} and V_{out} should be constrained to the range $V_{SS} \leq (V_{in} \text{ or } V_{out}) \leq V_{DD}$.

Unused inputs must always be tied to an appropriate logic voltage level (e.g., either V_{SS} or V_{DD}). Unused outputs must be left open.

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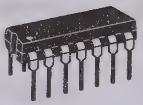
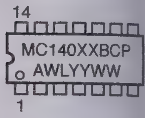
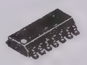
MARKING DIAGRAMS

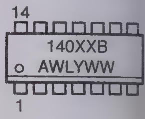


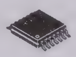
PDIP–14
P SUFFIX
CASE 646



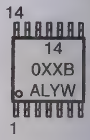


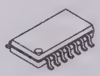
SOIC–14
D SUFFIX
CASE 751A



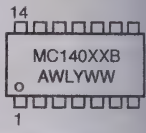


TSSOP–14
DT SUFFIX
CASE 948G





SOEIAJ–14
F SUFFIX
CASE 965



XX = Specific Device Code
A = Assembly Location
WL or L = Wafer Lot
YY or Y = Year
WW or W = Work Week

DEVICE INFORMATION

Device	Description
MC14001B	Quad 2–Input NOR Gate
MC14011B	Quad 2–Input NAND Gate
MC14023B	Triple 3–Input NAND Gate
MC14025B	Triple 3–Input NOR Gate
MC14071B	Quad 2–Input OR Gate
MC14073B	Triple 3–Input AND Gate
MC14081B	Quad 2–Input AND Gate
MC14082B	Dual 4–Input AND Gate

ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 11 of this data sheet.

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WB5RVZ.Org - Ensemble HF/LF RX II

Ensemble RX II (HF/LF) Local Oscillator and Control Band: LF

Introduction

Band Specific Components

This stage involves band-specific components and is currently configured for the LF band. If you need to configure this page for a different band, click on the "Band" tab in the menu above. This would take you to the home page, where you can select the new band and then return to this page.

General Info About the Stage

This stage completes the component installation for the isolated USB ground plane and implements:

- the microcontroller and
- the local oscillator functionality.

The microcontroller implements a USB device which can control frequency of the programmable oscillator (Si570) and provides programmatic band-select switching signals to select from among bands 0, 1, 2, and 3. These bands are "super bands" which, depending upon the builder's choice of options, provide coverage of the traditional HF bands or a set of HF bands plus 6m.

> It is important to remember that the Local Oscillator does not output at the desired center frequency for your band; it produces an output at a frequency that is:
>
> - For the HF option, 4 times the desired center frequency
> - For the LF optikon, 16 times the desired center frequency

Theory of Operation

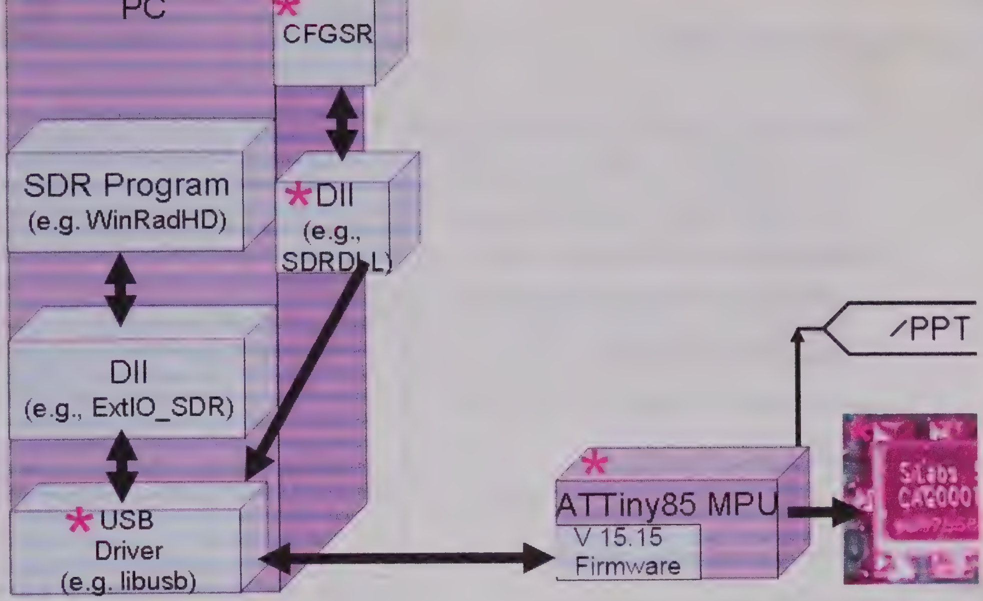
There are two components to this theoretical discussion: hardware and software

Hardware

The hardware part is fairly straight=forward. The two primary components installed here are the ATTINY-85 microcontroller (a USB device) and the Si570 Programmable Oscillator The microcontroller, reacting to signals from the PC, puts the Si570 through its paces. Actions include configuring the Si570 for operation and, of course, setting its output frequency to a desired value (which is 4 times the desired "center-frequency" of the radio). The Si570 can also respond to sytatus inquiries from the microcontroller. The output of the Si570 is provided to the "radio" side of the radio via the isolation transformer, T1.

In addition, this stage provides the bandswitching control (from the microcontroller) to optoisolators U4 and U5, crossing the galvanic boundqary between the USB side and the "radio" side.

SDR Software Architacture



The above diagram illustrates the various pieces and their places in the SDR Software architecture. The Radio's critical functionality is provided via the SDR Program. Examples of this include Rocky, HDSDR, SDR#, PowerSDR, PowerSDR-IQ, and others. Each program has its plusses and minuses and it is up to the builder to decide which to use.

The SDR program needs a was to tell the hardware's LO what it should do. There is normally an intermediary piece of software (a "dll") that provides the interface between the SDR software and another (very low level) piece of software called a driver. In the Ensemble's case, the driver is a variant on the "libUSB"

USB driver. The microcontroller on the Ensemble (ATTINY-85) is a computer which "looks like" a USB device to the PC. This is where the USB driver comes in. Every USB device needs some sort of driver that allows the PC's operating system to "recognize" the USB device. The ATTINY-85 is no exception.

The dll talks to the USB device (ATTINY-85) through the USB driver.

contained in this dissertation because Simpson et. al recorded the experimental data in the time domain and while the numerical analysis was done in the frequency domain. Using Fourier transform techniques, a method of taking the theoretical data back to the time domain was sought. If one were to naively take the numerical inverse Fourier transform of the unmodified perfect conducting Z(ω) in an attempt to find the impulse response, it would be apparent from finding non-causal results that a problem exists in the calculated time domain data.

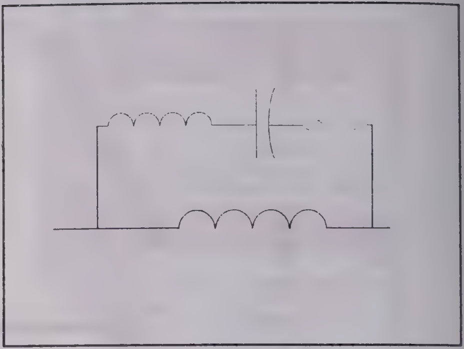


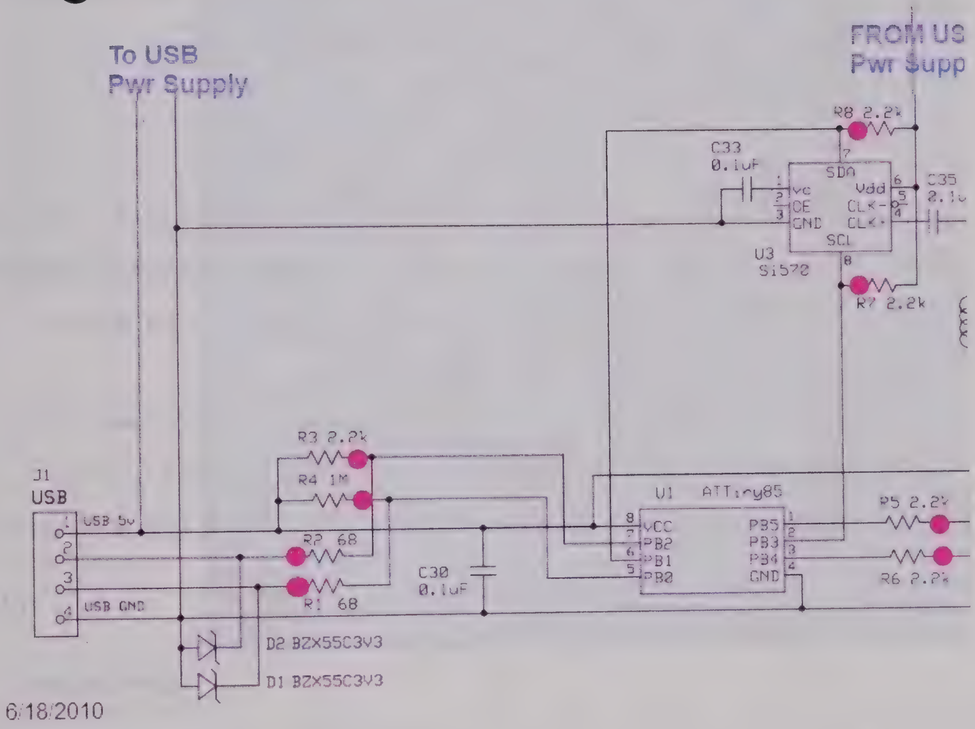
Figure 4-2. Non-ideal circuit equivalent of Fig. 4-1. This circuit was used to modify the beam impedance response for below cutoff cavity modes.

Modifying the computed data near the parallel resonant frequency solved the problem of computing the wakefield. This modification was performed by comparing the response of the ideal problem depicted in Fig. 4-1 to that of a more realistic coupled resonator problem shown in Fig. 4-2. For this circuit, Z(ω) takes on the form:

$$Z(\omega)=\frac{i\omega^3 L_{cavity}L_{couple}C+\omega^2 L_{couple}RC-i\omega L_{couple}}{\omega^2 C(L_{cavity}+L_{couple})-i\omega RC-1}. \tag{4-9}$$

The ATTINY-85 then reacts to the signals "delvered" via the PC's USB port into which the cable is plugged. The USB signals (Data+ and Data-) are translated by the ATTINY-85 (running the "firmware" that is pre-loaded into the device) into signals that are recognized by the Si570. Since the USB bus is bi-directional, the Si570 can communicate status back to the PC. Similarly, the ATTINY-85 can send hi/lo signals to the opto-isolators controlling things like PTT (on the RXTX) or Band Switching (on the RX) and can receive dash and dot input lines from an attached paddle (in the case of the RXTX).

Stage Schematic



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Click here for full schematic

(Red dots represent the "hairpin" (or left-hand or topmost) lead of the component)

$$\Xi \triangleq \begin{bmatrix} \cdots & \vdots & & & \vdots \\ \cdots & \xi_{0,0} & \xi_{1,0} & \cdots & \xi_{l,0} & \cdots \\ \cdots & \xi_{0,1} & \xi_{1,1} & \cdots & \xi_{l,1} & \cdots \\ \cdots & \vdots & & & \vdots \\ \cdots & \xi_{0,p} & \xi_{2,p} & \cdots & \xi_{l,p} & \cdots \\ \cdots & \vdots & & & \vdots \end{bmatrix} \tag{4-5}$$

The formulae for the $\xi_{l,p}$ and integrals which aid in both the calculation and asymptotics of Eq. 4-4 are listed in Appendix D. Using this definition, the RHS of Eq. 4-4 is simply $\sum_{l=-\infty}^{\infty} \gamma_l \xi_{l,p}$.

The final term to insert into the complex Fourier-analysis is the left hand side (LHS) of Eq. 1-12, which defines the source of excitation. Designate the quantity:

$$\varphi_p \triangleq \frac{2\pi Z_0}{ika} \int_0^g dz\, \vec{H}_\phi^{\,s}(r=a,z,\omega)\cdot\hat{z}\, e^{-i\left(\frac{2p\pi z}{g}\right)}, \tag{4-6}$$

where $\vec{H}_\phi^{\,s}(r=a,z,\omega)$ is the magnetic field intensity for a particular source distribution (e.g. Eqs. 2-2, 2-4, 2-7, or 2-9). Using the definition for φ_p in Eq. 4-6, define the vector Φ:

Board Layouts

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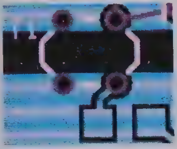
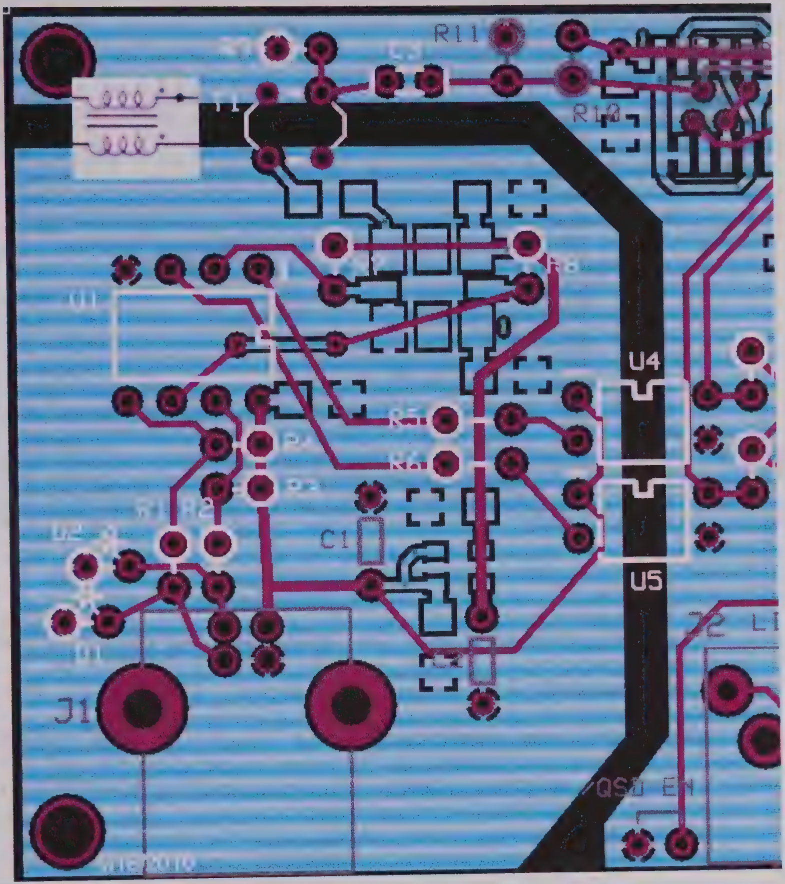
6/20/2013
Board Mod





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Board Bottom

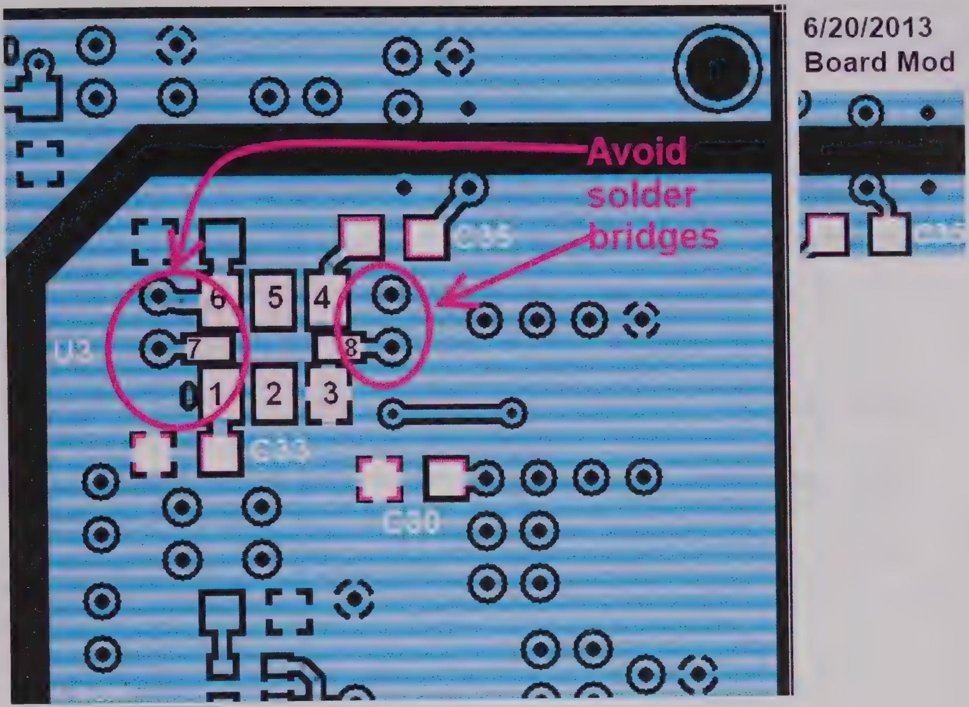
by the column vector Γ.

Now consider the influence of the cavity kernel. The cavity contribution is solved for by substituting the appropriate sum from the terms in Eqs. 3-1, 3-2, and 3-3 into the definition of the cavity kernel in Eq. 1-7. Multiplying the cavity kernel by $e^{-i\frac{2p\pi z}{g}}$ and integrating z over {0≤z≤g} results in:

$$\int_0^g dz \int_0^g dz' f(z') K_c(z,z') e^{-i\left(\frac{2p\pi z}{g}\right)} = \int_0^g dz \int_0^g dz' \sum_{l=-\infty}^{\infty} \gamma_l e^{i\left(\frac{2l\pi z}{g}\right)} K_c(z,z') e^{-i\left(\frac{2p\pi z}{g}\right)} \tag{4-4}$$

Again, assume that the integral in Eq. 4-4 is uniformly convergent for {0≤z≤g, 0≤ z'≤g}, and it is therefore possible to pull the summation over l out of the integral. For compact writing, make the following definitions:

$$\xi_{l,p} \triangleq \int_0^g dz \int_0^g dz' e^{\left(i\frac{2l\pi z'}{g}\right)} K_c(z,z') e^{\left(-i\frac{2p\pi z}{g}\right)}$$



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Summary Build Notes

1. Install Protective Topside Parts
2. Install Bottomside Components
3. Wind and Install T1
4. Install Topside Ics
5. Install Remainder of Topside Components
6. Download and Install Required Software
7. Configure Si570 for LF Option
8. Test the Stage

Local Oscillator and Control Bill of Materials (LF band option)

$\{0 \le z \le g,\ 0 \le z' \le g\}$, it is therefore possible to pull the summation out of the integrand, resulting in the following equation:

$$= \sum_{l=-\infty}^{\infty} Y_l \int_0^g dz \int_0^g dz' e^{\left(i\frac{2l\pi z'}{g}\right)} K_p(|z-z'|)\, e^{\left(-i\frac{2p\pi z}{g}\right)}.$$

For compact writing, make the following definitions:

$$\theta_{l,p} \triangleq \int_0^g dz \int_0^g dz' e^{\left(i\frac{2l\pi z'}{g}\right)} K_p(|z-z'|)\, e^{\left(-i\frac{2p\pi z}{g}\right)} \tag{4-3}$$

$$\Theta \triangleq \begin{bmatrix} \cdots & \vdots & & & & \vdots \\ \cdots & \theta_{0,0} & \theta_{1,0} & \cdots & \theta_{l,0} & \cdots \\ \cdots & \theta_{0,1} & \theta_{1,1} & \cdots & \theta_{l,1} & \cdots \\ \cdots & \vdots & & & & \vdots \\ \cdots & \theta_{0,p} & \theta_{2,p} & \cdots & \theta_{l,p} & \cdots \\ \cdots & \vdots & & & & \vdots \end{bmatrix} \qquad \Gamma \triangleq \begin{bmatrix} \vdots \\ Y_0 \\ Y_1 \\ \vdots \\ Y_p \\ \vdots \end{bmatrix}$$

The formulae for the $\theta_{l,p}$ and integrals which aid in both the calculation and the asymptotics of Eq. 4-3 are listed in Appendix D. Using this notation, the RHS of Eq. 4-2 may be rewritten as $\sum_{l=-\infty}^{\infty} Y_l \theta_{l,p}$, or the pth row vector of Θ multiplied

Check	Type	Category	Component	Count	Marking	Ii
☐	Capacitor	Ceramic	0.01 uF	1	103	
☐	Capacitor	SMT 1206	0.1 uF	3	(smt) black stripe	
☐	Diode	Axial	BZX55C3V3 3.3V zener diode	2	BZX55C	
☐	IC	DIP 8	ATtiny 85-20 PU w/V15.12 Firmware	1	AVR ATTINY85-20PU ESD!!!	
☐	IC	DIP-4	LTV-817 Opto-Isolator	2	LTV 817 ESD!!!	
☐	IC	I2C	Si570 Programmable Oscillator	1	SiLabs 570 ESD!!!	
☐	inductor	Binocular core	BN-43-2402 (no markings!)	1	none	
☐	Inductor	xfrmr	12.96uH: 3T(bi)T #30(10 (2x5)in) on BN43-2402	1		
☐	Resistor	1/6W	68 1/6W 5%	2	bl-gry-blk-gld	
☐	Resistor	1/6W	2.2k 1/6W 5%	6	red-red-red-gld	
☐	Resistor	1/6W	10 k 1/6W 5%	2	brn-blk-ora-gld	

IV. Charged Particle Beam Solution

A. Theoretical Solution to the Integral Equation

A method of estimating the solution to the integral equation in Eq. 1-12 using a Fourier series technique is introduced. This technique takes advantage of the orthogonality and completeness of the set of $e^{i\frac{2l\pi z}{g}}$ terms for a bounded interval of length g. Applying standard Fourier series techniques, make the following definition:

$$f(z,\omega) \triangleq \sum_{l=-\infty}^{\infty} \gamma_l(\omega)\, e^{\left(i\frac{2l\pi z}{g}\right)} u_g(z), \tag{4-1}$$

where $f(z,\omega)=E_z(r=a,z,\omega)$. The presence of $u_g(z)$, defined in Ch. III, says that the representation of f(z) by the Fourier series is to take place on the interval $\{0 \le z \le g\}$. Multiplying Eq. 1-12 by $e^{-i\frac{2p\pi z}{g}}$ and integrating z over $\{0 \le z \le g\}$, while using the definition of Eq 4-1 for $f(z,\omega)$, the pipe kernel term on the RHS of Eq. 1-12 becomes:

$$\begin{aligned}&\int_0^g dz \int_0^g dz' f(z')\, K_p(z-z')\, e^{\left(-i\frac{2p\pi z}{g}\right)} = \\ &\quad \int_0^g dz \int_0^g dz' \sum_{l=-\infty}^{\infty} \gamma_l\, e^{\left(i\frac{2l\pi z'}{g}\right)} K_p(|z-z'|)\, e^{\left(-i\frac{2p\pi z}{g}\right)}\end{aligned} \tag{4-2}$$

Assuming that this summation is uniformly convergent for

☐	Resistor	1/6W	1 M 1/6W 5%	1	brn-blk-grn-gld	
☐	socket	Socket	8 pin dip socket	1		
☐	wire	Magnetic	Magnetic Wire, enameled #30	1		

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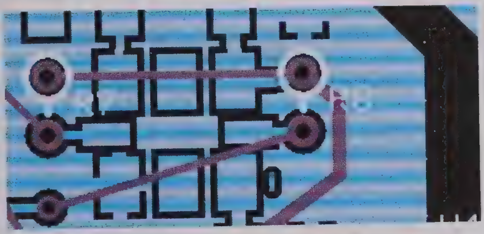
Detailed Build Steps

Install Protective Topside Parts



Install these resistors first, so as to protet against solder splashover at pins 4 and 8 off the Si570 (see below)

Check	Designation	Component (top/bottom)	Orientation	Marking	Image
☐	R07	2.2k 1/6W 5% (top)	N-S	red-red-red-gld	
☐	R08	2.2k 1/6W 5% (top)	N-S	red-red-red-gld	

transformed into a new integral equation. This equation shows some interesting properties. First, only the even part of f(q) contributes to the cavity interaction, which is only a consequence of the choice in the definition for the cavity location along the z axis. Next, note that since H(q) is the Fourier transform of a cosine function, H(q) is comprised of two delta functions. Furthermore, the convolution of F(q)H(q) with $u_g(q)$ effectively generates a sum of shifted $u_g(q)$, each scaled by a sampled f(q) at each of the eigenmodes of the cavity. This makes Eq. 3-5 a difficult equation to solve for f(q). The fact that f(q) is sampled at the cavity resonant frequencies suggests using a Fourier series technique to solve the original integral equation in Eq. 1-12. The Fourier series technique will be presented in Ch. IV. It is not apparent, however, how to readily solve the new integral equation. Perhaps with the use of other transformations and mathematical manipulations the new integral equation may be solved.

Install Bottomside Components

Watch out when installing C35 to avoid solder splashover into the adjacent holes for the T1 primary windings.

Note the orientation photo for the Si570 and install with correct orientation.

Pay close attention to the pins 4 , 7, and 8, as their footprint is quite small relative to the other pads. The very tight space around those pins and the multiple contacts in close proximity can easily lead to frustrating solder bridges.

Check	Designation	Component (top/bottom)	Orientation	Marking	Image
☐	C30	0.1 uF ((bottom))	white pads	(smt) black stripe	
☐	C33	0.1 uF ((bottom))	white pads	(smt) black stripe	
☐	C35	0.1 uF ((bottom))	white pads	(smt) black stripe	

Rewriting the right-hand side (RHS) of Eq. 1-12 using this functional form of the cavity kernel shows:

$$\int_{-\infty}^{\infty} dz' f(z') u_g(z') \, [K_p(|z-z'|) + (h(z-z') + h(z+z'))] \tag{3-4}$$

Equation 3-4 is expressed in a format similar to a convolution integral. Convolution integrals have the property that they may be transformed into a simple multiplication operation with the aid of the Fourier transform. Consider taking the spatial Fourier-transform of Eq. 3-4 with respect to z, resulting in:

$$f(q)K_p(q) + \frac{1}{2\pi} f(q)h(q) \otimes u_g(q) + \frac{1}{2\pi} u_g(q) \otimes \mathscr{F}\Big(\int_{-\infty}^{\infty} f(z')h(z+z')dz'\Big)_z .$$

The quantity $\mathscr{F}\big(\int_{-\infty}^{\infty} f(z')h(z+z')dz'\big)_z$ is outlined in Appendix C and is F(-q)H(q).

Taking the Fourier-transform of Eq. 3-4 results in:

$$\mathscr{F}\left\{\frac{2\pi Z_0 H_\phi{}^s(r=a,z)}{ika}\right\}_z = \frac{2\pi Z_0 H_\phi{}^s(r=a,q)}{ika} = f(q)K_p(q) + \\ + \frac{1}{2\pi} u_g(q) \otimes [(f(q) + f(-q))H(q)] . \tag{3-5}$$

In Eq. 3-5 the unknown quantity to solve for is f(q). It is evident that the original integral equation is now

☐	U03	Si570 Programmable Oscillator ((bottom))		SiLabs 570 ESD!!!	

Wind and Install T1

Inductor Information

Common Techniques:

- One turn:
  - For toroids, one turn is a single pass through the center hole.
  - For binocular cores, one turn is a pass in which the wire goes in the bottom, comes out the top, goes back in the other hole at the top, and comes out the other hole at the bottom.
- Bi (tri) filar means 2(3) equal lengths of wire. You get the bi(tri)filar strand by taking the length of wire specified for the primary winding, folding it into half(thirds), twisting it to 3~ twists per inch, and winding it over the primary winding. One end of such a strand will have two(three) leads; the other end will have a "hairpin" bend (and a single lead in the case of tri-filar).
- Multi-filar windings are usually done AFTER the uni-filar winding is done.
- Windings shoud be evenly spaced and ideally made such that the winding covers ~345 degrees of the toroid
- Inductance values given are for the single (uni-filar) winding. They are provided to help verify turn counts and core material selected.
- Toroid nomenclature provides the outside diameter of the toroid (in

$$\vec{E}_l(r,z)=\hat{r}\frac{1}{\sqrt{g\pi\ln\left(\frac{b}{a}\right)r}}\sin\left(\frac{l\pi z}{g}\right)u_g(z).$$

The TEM resonant frequencies are:

$$\omega_l^2=c^2\left(\frac{l\pi}{g}\right)^2$$

and l={1,2,3...}. An additional mode is necessary to accommodate the energy storage of the DC fields [9]. The normalized magnetic field distribution is:

$$h_l(r,z)=\frac{1}{\sqrt{2\pi g\ln\left(\frac{b}{a}\right)r}}. \tag{3-3}$$

Applying the TM and TEM definitions from Eqs. 3-1, 3-2, and 3-3 for the $h_l(r,z)$ shows that the cavity kernel in Eq. 1-7 is specifically dependent on a product of cosine terms of equal frequency. By using a trigonometric identity that the product of cosines is a modulator:

$$\cos(\lambda)\cos(\nu)=\frac{1}{2}[\cos(\lambda-\nu)+\cos(\lambda+\nu)],$$

the cavity kernel can be rewritten into a sum of cosines rather than a product of cosines. Consider rewriting the cavity kernel into a functional form, replacing the infinite sum of cosine terms with the functions h(z-z') and h(z+z').

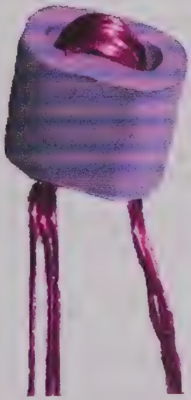
hundredths of an inch - the "30" in "T30-2"), and material code (the "2" in "T30-2"). Color codes used in these kits are:

- 2=Red
- 3=Gray
- 6=Yellow
- 7=White
- 10=Black
- 12=Green (with White on opposite side)

Inductors In This Step

T01

XFRMR: 12.96uH: 3T(bi)T #30(10 (2x5)in) on BN43-2402
Using a total of approximately 9 inches of #30 wire, wind 3 turns , bifilar, on a BN-43-2402 ferrite.Inductance of the single winding (usually the primary) is 12.96 uH.



After two turns with the twisted pair you have a transformer with two windings (each winding corresponding to one of the two twisted single wires).
Each winding (primary and secondary) is two turns. Since the windings are identical in length and number of turns, you can arbitratily pick either one as the primary, with the remaining winding serving as the secondary winding.
(Hont: use an ohmmeter (or other continuity checker) to identify which wire-ends go together to make the ends of a winding.

$$\vec{E}_{l,m}\cdot\hat{r}=\frac{A_{l,m}c\sqrt{\pi}}{\omega g^{3/2}}\left(Y_0(\beta_m a)\,J_1(\beta_m r)-J_0(\beta_m a)\,Y_1(\beta_m r)\right)\sin\left(\frac{l\pi z}{g}\right), \qquad (3\text{-}1)$$

$$-iZ_0\vec{H}_{l,m}\cdot\hat{\phi}=h_{l,m}(r,z)=$$

$$=\frac{A_{l,m}}{\sqrt{\pi g}}\,[J_0'(\beta_m r)\,Y_0(\beta_m a)-Y_0'(\beta_m r)\,J_0(\beta_m a)]\cos(\frac{l\pi z}{g})\,u_g(z),$$

where the β_m's solve $J_0(\beta_m b)\,Y_0(a)-Y_0(\beta_m b)\,J_0(\beta_m a)=0$ **and the $A_{l,m}$'s are defined by:**

$$A_{l,m}=\frac{1}{\sqrt{\int\int_{cavity}\vec{h}_{l,m}\cdot\vec{h}^{*}_{l,m}d\tau}}$$

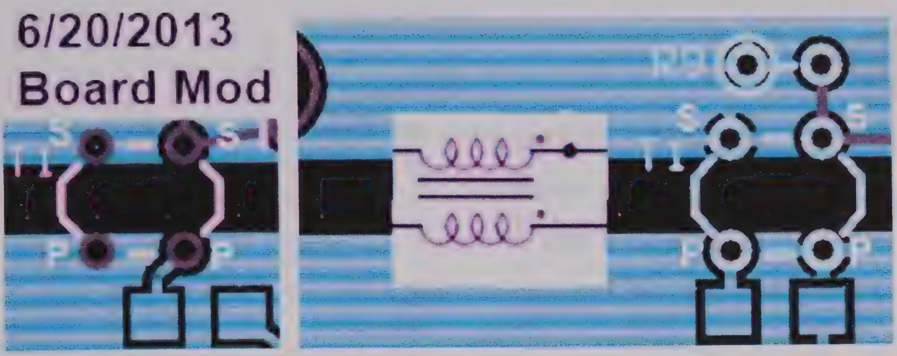
$$=\frac{1}{\sqrt{\left(1+\delta_{l,0}\right)\int_a^b r\left(J_0(\beta_m a)\,Y_1(\beta_m r)-Y_0(\beta_m a)\,J_1(\beta_m r)\right)^2 dr}}.$$

The resonant frequencies of the TM cavity modes are:

$$\omega^2_{l,m}=c^2(\beta^2_m+(\frac{l\pi}{g})^2).$$

The TEM modes in this annular region have the following field structure:

$$-iZ_0\vec{H}_l(r,z)\cdot\hat{\phi}=h_l(r,z)=\frac{1}{r\sqrt{\pi g\ln(\frac{b}{a})}}\cos(\frac{\pi l z}{g})\,u_g(z), \qquad (3\text{-}2)$$



Alert!!!! Examination of the Ensemble receiver PCBs dated 6/15/2010 shows the grounding point of the two windings of the LO isolating transformer, T1, are diagonally apart, not adjacent. The ground connection of the primary winding is on the right; the ground for the secondary winding is on the left. If the local oscillator isolation transformer is not connected properly some of the Si570 fundamental and harmonics will be radiated from the USB and other cables. The principle is that the grounded side of the isolation transformers should go to the same end of the primary and secondary. The two wires that come from the same hole in the binocular core.must be switched (for one of the windings, primary or secondary - your choice). See the article by Alan G4ZFQ for IMPORTANT details.

There has been a revision of the PCB (look for the 6/20/2013 date on the board) which makes this switching of the leads unnecessary.

So check your board version to see which approach to mounting the transformer applies.

Check	Designation	Component (top/bottom)	Orientation	Marking	Image
☐	magwire	Magnetic Wire, enameled #30 (top)			

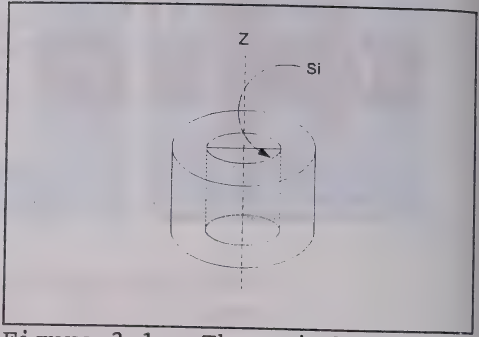


Figure 3-1. The ϕ independent discontinuity or cavity region. The cavity region is chosen such that it lies exterior to the beampipe region. This effectively makes the cavity modes independent of the geometry exterior to the cavity.

properties of the Fourier transform; this new integral equation suggests a new method for estimating the solution with linear algebra.

Upon close examination of the cavity kernel $K_c(z,z')$ in Eq. 1-7, the transformed integral equation can be arrived at in a fairly straightforward manner.

In Eq. 1-7, $h_l(r,z)$ is the normalized magnetic field for a particular mode of the coaxial cavity depicted in Fig. 3-1, with length g, and inner and outer conductors of radii a and b, respectively. Note that with these definitions, the cavity region is identical in both the problem with the center conductor and with a physical beam.

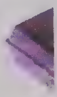
The TM modes for the cavity depicted in Fig. 3-1 have the following field structure (l=0, 1, 2, 3, ...; m=1, 2, 3, ...):

$$\vec{E}_{l,m}\cdot\hat{z} = \frac{A_{l,m}\beta_m c}{\omega\sqrt{\pi g}}\left(Y_0(\beta_m a)\, J_0(\beta_m r) - J_0(\beta_m a)\, Y_0(\beta_m r)\right)\cos\left(\frac{l\pi z}{g}\right),$$

☐	T01-core	BN-43-2402 (no markings!) (top)		none	
☐	T01	12.96uH: 3T(bi)T #30(10 (2x5)in) on BN43-2402 (top)			

Install Topside Ics

Double check the orientation on the two optoisolators. They should be oriented so that their "dimple" is in the upper left-hand corner.

Check	Designation	Component (top/bottom)	Orientation	Marking	Imag
☐	S01	8 pin dip socket (top)			
☐	U01	ATtiny 85-20 PU w/V15.12 Firmware (top)	(dimple in upper right)	AVR ATTINY85-20PU ESD!!!	

III. Determination of a New Integral Equation

Using simple linear system theory Eq. 1-12 can be cast into a different form. The effect of all the cavity modes on the integral equation in Eq. 1-12 will be pointed out. It is an additional goal of this chapter to point out the steps to the realization of a new integral equation. The new integral equation turns out to be rather complicated and will not be solved.

A. Background Definitions

To represent the location of the cavity resonator (see Fig. 1-9) it is necessary to define a new function $u_g(z)$:

$$u_g(z)=u(z)-u(z-g),$$

where u(z) is the Heaviside step function defined in Ch. II. The function $u_g(z)$ is therefore:

$$u_g(z)=\begin{cases}1 & z\in[0,g]\\ 0 & z\notin[0,g]\end{cases}.$$

Note that this new function $u_g(z)$ has the convenient property that $u_g(z)=u_g(z)u_g(z)$. Taking the Fourier transform of $u_g(z)$ with respect to z shows: $U_g(q)=\mathscr{F}\{u_g(z)\}_z=\mathscr{F}\{u_g(z)\,u_g(z)\}_z=\frac{1}{2\pi}U_g(q)\otimes U_g(q)$. The $\otimes$ symbol represents the convolution operation.

B. Derivation of Equation

The integral equation derived by Gluckstern may be transformed into another integral equation using simple

☐	U04	LTV-817 Opto-Isolator (top)	(dimple in upper left)	LTV 817 ESD!!!	
☐	U05	LTV-817 Opto-Isolator (top)	(dimple in upper left)	LTV 817 ESD!!!	

Install Remainder of Topside Components

Careful installing the resistors and diodes clustered near the USB connector area. Builders have been known to insert these into the wrong holes. Review the board layout and the orientation column below to double check the orientation.

The body of each zener is to be located above the silkscreen circles for D1 and D2 on the board with the diodes mounted standing perpendicular to the board in a hairpin fashion. The banded end of each diode is then at the lead of the diode that loops back to the circuit board.

Check	Designation	Component (top/bottom)	Orientation	Marking	Image
☑	C03	0.01 uF (top)	horiz	103	
☑	D1	BZX55C3V3 3.3V zener diode (top)		BZX55C	

the source $\vec{J}=0$) which will satisfy the boundary conditions everywhere. The remainder of this dissertation discusses how one finds the homogeneous solution and comments on the validity of the calculated solution.

☑	D2	BZX55C3V3 3.3V zener diode (top)		BZX55C	
☑	R01	68 1/6W 5% (top)	N-S	bl-gry-blk-gld	
☑	R02	68 1/6W 5% (top)	N-S	bl-gry-blk-gld	
☑	R03	2.2k 1/6W 5% (top)	E-W	red-red-red-gld	
☑	R04	1 M 1/6W 5% (top)	E-W	brn-blk-grn-gld	
☑	R05	2.2k 1/6W 5% (top)	W-E	red-red-red-gld	
☑	R06	2.2k 1/6W 5% (top)	W-E	red-red-red-gld	
☑	R09	2.2k 1/6W 5% (top)	W-E	red-red-red-gld	
☑	R12	10 k 1/6W 5% (top)	N-S	brn-blk-ora-gld	
☑	R13	10 k 1/6W 5% (top)	N-S	brn-blk-ora-gld	

Download and Install Required Software

All of the latest versions of essential firmware configuration programs,

$$\vec{J}(\vec{r},\omega) = I_o \frac{\sin\left(\frac{\omega\kappa\sigma}{2c}\right) e^{-i\omega\frac{z}{c}}}{\omega\left(\omega^2 - \left(\frac{2\pi c}{\kappa\sigma}\right)^2\right)} \frac{\delta(r)}{2\pi r}\hat{z}$$

and the Fourier-transformed electric and magnetic fields for the time-limited-cosine-squared current source are:

$$\vec{E}^s(\vec{r},\omega) = \frac{Z_o I_o}{2\pi r} \frac{\sin\left(\frac{\omega\kappa\sigma}{2c}\right) e^{-ikz}}{\omega\left(\omega^2 - \left(\frac{2\pi c}{\kappa\sigma}\right)^2\right)}\hat{r} \tag{2-9}$$

and

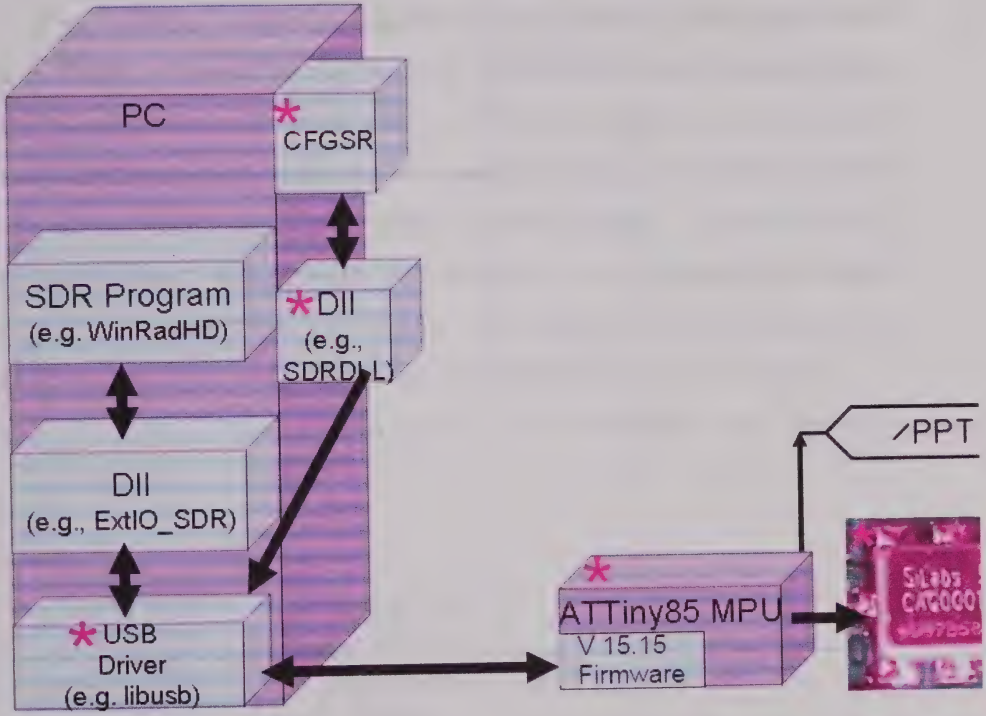
$$\vec{H}^s(\vec{r},\omega) = \frac{I_o}{2\pi r} \frac{\sin\left(\frac{\omega\kappa\sigma}{2c}\right) e^{-ikz}}{\omega\left(\omega^2 - \left(\frac{2\pi c}{\kappa\sigma}\right)^2\right)}\hat{\phi}.$$

F. Summary

The source fields presented in this chapter are the *particular* solutions to Maxwell's equations. The complete solution adds to these fields the homogeneous solution (where

USB driver and their associated documentation can be obtained from Fred PE0FKO's website:

- Amateur Radio Certificate Authority
- USB driver: (search for "Download Firmware source and .hex files")
- CFGSR program: (search for "Download")
- Documentation



In order to test (and later, operate) your rig, you must download and install required software (SDR programs and Dynamic Link Libraries, along with hardware drivers. The actual steps and programs may vary, depending upon your computer's windows operating system version (XP, Vista, Windows 7, or Windows 8) and architecture CPU/memory (32 bit or 64 bit).

The following links are provided and, as of 1/22/2012, are current. Links highlighted in an Aqua-colored background apply only to those Softrock kits that use the SI570 programmable oscillator:

Software	Role/Purpose	Function	Download Link

3.517868. This value will be used throughout the remainder of this dissertation. A graph of a particular Gaussian (σ=4.0mm) and a time-limited-cosine-squared current distribution (σ=4.0mm, κ=3.517868) is shown in Fig. 2-1. Each current source in Fig. 2-1 is normalized to contain an equal charge of $q=2.31\times10^{-9}$ C. The important feature of Fig. 2-1 is the similarity of the two current distributions using the minimum κ. Additionally, Fig. 2-1 shows the tails of the Gaussian decaying as $z\to\pm\infty$ and the time/space limitation of the cosine-squared source at $z=\pm\frac{\kappa\sigma}{2}\approx\pm0.0067$ mm.

The Fourier transform of the time-limited-cosine-squared current distribution of Eq. 2-8 is:

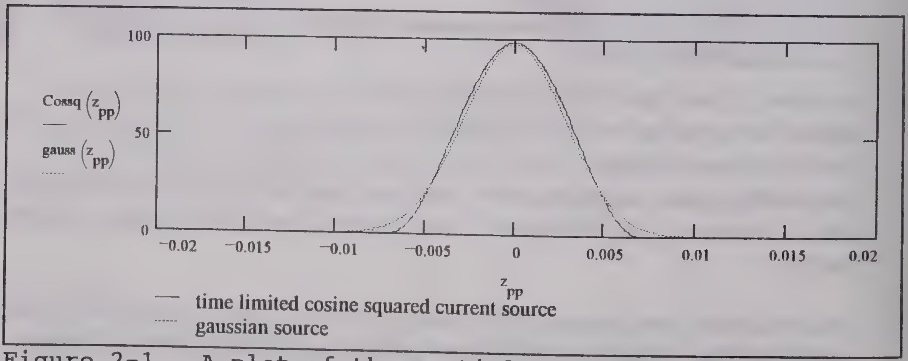


Figure 2-1. A plot of the spatial dependence (mm) for equal charge current distributions of a time-limited-cosine-squared source of Eq. 2-8 using the minimum κ and σ=4mm versus a Gaussian current source of Eq. 2-5 with σ=4mm.

CFGSR	Configure/Control Ensemble microcontroller	Configure	download
SRDLL	dll for other Softrock controllers	Control	
New All-In-One Driver Installer (See Section Titled "Install the PC driver software automatic"	New installer for "signed" PE0FKO-USB-Driver from Fred, PE0FKO.	Driver	Download

dependence of the fields to the case of the impulse of current. The salient difference in the transformed fields between the impulse of current and the Gaussian bunch is the attenuation of the fields for the Gaussian bunch with increasing frequency.

E. Ultra-relativistic Time-Limited-Cosine-Squared Bunch

Consider the time-limited-cosine-squared current distribution:

$$\vec{J}(\vec{r},t)=$$

$$=\frac{-I_o\kappa^2\sigma^2}{4\pi^2c^2}\cos^2\left(\frac{\pi(z-ct)}{\kappa\sigma}\right)\left(u\left(z-ct+\frac{\kappa\sigma}{2}\right)-u\left(z-ct-\frac{\kappa\sigma}{2}\right)\right)\frac{\delta(r)}{2\pi r}\hat{z} \quad (2\text{-}8)$$

where the function u(z) is the Heaviside step function:

$$u(z)=\begin{cases}1 & z\geq 0\\ 0 & z<0'\end{cases}$$

and of total charge $q=I_0\frac{\kappa\sigma}{c}$. The parameter κ is chosen such that this distribution most closely resembles the Gaussian distribution described in Eq. 2-5. This was accomplished by minimizing the following function of κ:

$$\int_{-\frac{\kappa\sigma}{2}}^{\frac{\kappa\sigma}{2}}\left(e^{-\left(\frac{z}{\sigma}\right)^2}-\cos^2\left(\frac{\pi z}{\kappa\sigma}\right)\right)^2 dz.$$

The minimum κ was found numerically and is equal to $\kappa=$

USB driver(s)	drivers for ATTiny85 USB	Driver	download
(32/64 bit Windows 7, Vista, XP) PowerSDR-V2.4 For Homemade SDR Transceivers	Latest Version of FlexRadio's PowerSDR tailored for I/Q Soundcard-based SDRs. Click here for installation instructions.	RXTX	download

The Fourier-transformed source fields are:

$$\vec{E}^{s}(\vec{r},\omega)=\frac{Z_o I_o}{2\pi r}e^{-ikz}\hat{r} \qquad \vec{H}^{s}(\vec{r},\omega)=\frac{I_o}{2\pi r}e^{-ikz}\hat{\phi}. \tag{2-4}$$

By comparing Eqs. 2-2 and 2-4 one concludes that the source fields of an ultra-relativistic charged particle and the source fields of an impulse of current on a wire are indistinguishable. The feature that the source fields are the same between the wire and relativistic beam gave Sands and Rees [3] the notion to use a SWM to estimate the wakefield.

D. Ultra-relativistic Gaussian Bunch.

Consider the ultra-relativistic Gaussian bunch with total charge q=I_o. For this source,

$$\vec{J}(\vec{r},t)=\frac{I_o c}{\sigma\sqrt{\pi}Z_0}e^{-\left(\frac{z-ct}{\sigma}\right)^2}\frac{\delta(r)}{2\pi r}\hat{z}. \tag{2-5}$$

The Fourier-transformed source and its fields are:

$$\vec{J}(\vec{r},\omega)=\frac{I_o}{Z_0}e^{-ikz}e^{-\left(\frac{k\sigma}{2}\right)^2}\frac{\delta(r)}{2\pi r}\hat{z}, \tag{2-6}$$

$$\vec{E}^{s}(\vec{r},\omega)=\frac{Z_o I_o}{2\pi r}e^{-ikz}e^{-\left(\frac{k}{2\sigma}\right)^2}\hat{r} \qquad \vec{H}^{s}(\vec{r},\omega)=\frac{I_o}{2\pi r}e^{-ikz}e^{-\left(\frac{k}{2\sigma}\right)^2}\hat{\phi}. \tag{2-7}$$

The importance of Eq. 2-7 is the similarity in the z

SDR #	SDR # ("SDR Sharp") for RX	RX	Download
Rocky (V3.7)	Simple SDR (RX/TX) Program (see note below)	RXTX	download

free space. A current source in the form of Eq. 2-1 produces the following source fields [8], denoted by a superscript s:

$$\vec{E}^s(\vec{r},t)=\frac{Z_o I_o c}{2\pi r}\delta(z-ct)\hat{r} \quad \vec{H}^s(\vec{r},t)=\frac{I_o c}{2\pi r}\delta(z-ct)\hat{\phi}.$$

Taking the Fourier transform[1] of Maxwell's equations with respect to time and using the current source in Eq. 2-1 results in the following electric and magnetic fields:

$$\vec{E}^s(\vec{r},\omega)=\frac{Z_o I_o}{2\pi r}e^{-ikz}\hat{r} \quad \vec{H}^s(\vec{r},\omega)=\frac{I_o}{2\pi r}e^{-ikz}\hat{\phi}, \tag{2-2}$$

where $k=\frac{\omega}{c}$.

C. Impulse of Current on a Center Conductor

Consider the problem of an impulse of current with total charge $q=I_o$ traveling along a center conductor of radius r_o in the beampipe of Fig. 1-9. This source has the following form:

$$\vec{J}(\vec{r},t)=I_o c\,\delta(z-ct)\frac{\delta(r-r_o)}{2\pi r}\hat{z}, \tag{2-3}$$

and will excite the following transverse electromagnetic (TEM) mode:

$$\vec{E}^s(\vec{r},t)=\frac{Z_o I_o c}{2\pi r}\delta(z-ct)\hat{r} \quad \vec{H}^s(\vec{r},t)=\frac{I_o c}{2\pi r}\delta(z-ct)\hat{\phi}.$$

---

[1] See Appendix B for the definition of the Fourier transform and Fourier transform variables used in this manuscript.

HDSDR (V2.51)	Elegant SDR (RXTX) Program (based upon original Winrad)	RXTX	download
(Windows XP) PowerSDR-IQ V1.12.20	Version of FlexRadio's PowerSDR tailored for I/Q Soundcard-based SDRs	RXTX	download
(Windows 7, Vista) PowerSDR-IQ V1.19.3.15	Earlier version of FlexRadio's PowerSDR tailored for I/Q Soundcard-based SDRs	RXTX	download
com0com	An open source null modem/virtual serial port	Utility (VSP)	• download Win 7 (64 bit SignedVersion • download for other Wi

II. Specific Source Considerations

A. Introduction

One technique used to estimate the beam impedance is the stretched wire measurement. This technique is used because the source fields of an ultra-relativistic bunch of charge are similar to an impulse of current on a center conductor. A review of these sources and their fields along with two other source geometries will be introduced.

Consider the geometry depicted in Fig. 1-9. Assume that the current source $\vec{J}(\vec{r},t)=\vec{J}(r,z,t)$ or equivalently, assume that the source is independent of ϕ and all $\frac{\partial}{\partial\phi}\equiv 0$. Maxwell's equations, which are repeated below, must be satisfied everywhere in the beampipe and cavity regions.

$$\nabla\times\vec{E}=-\mu\frac{\partial}{\partial t}\vec{H} \qquad \nabla\times\vec{H}=\varepsilon\frac{\partial}{\partial t}\vec{E}+\vec{J}$$

B. Ultra-relativistic Point Charge

Assume that the source current is comprised of a charged particle of charge $q=I_o$ moving at the speed of light along the center of the beampipe. This source current has the form of Eq. 2-1:

$$\vec{J}(\vec{r},t)=I_o c\,\delta(z-ct)\frac{\delta(r)}{2\pi r}\hat{z}, \tag{2-1}$$

where the function $\delta(r)$ is the Dirac delta function, c is the speed of light, and Z_o is the characteristic impedance of

	manager		platforms
VAC	Virtual Audio Cable - a software audio "patch cable"	Utility (VAC) - Free trial (but don't use trial on the air!)	Website for download: http://software.muzychenk /eng/vac.htm

[*] Note on installing PE0-FKO's USB Drivers: Fred's website has an excellent step-by-step guide to instaling the USB driver. However, see the All-In-One installer (it renders the instructions unnecessary)

objective comparative analysis between the effects can be made. Since the goal of the stretched wire measurement is to simulate a charged particle beam, an analysis between similar and dissimilar coupling structures should show where a regime of validity exists and for which frequencies the stretched wire measurement will adequately simulate an ultra-relativistic charged particle beam. With the Fourier series approximation, the theoretical solution of the stretched wire measurement and wakefield measurement can finally be easily shown to converge to similar solutions.

Install Driver

> To be extra safe, it is highly recommended that you install the drivers with no other USB devices connected directly to your PC during the install. If your mouse and/or keyboard are USB, reconnect them through a USB hub. This seems to help avoid the dreaded "Unknown Device" Problem.

The correct procedure is to download the driver and put it in a suitable folder, then plug in the USB lead, Windows should detect new hardware has been found and you need to manually point it to the folder containing the drive. It should then install correctly. Certainly does on Win2000 and XP. On Vista or Windows 7, there used to be some issues with driver signing. There have been messages on the forum describing methods of working around these issues. One such solution is addressed in the author's MOBO4.3 builders notes.

LibUSB - "Unknown Device" Error

Others have experienced the dreaded "Unknown Device" problem upon plugging in the USB cable after having installed the LibUsb driver. This "unknown device" problem (and a remedy for those who are using Logitech cordless mouse and/or various wireless internet connection adaptors) are discussed in message #45071 and Message #47755 on the Yahoo Softrock40 Group

Another valueable resource for troubleshooting the "unknown device" error is Alan's webpage Installing the ATTiny45/85 USB Controller

Install/Run CFGSR ("ConFiGureSoftRock")

Once the driver is installed, if you run 'CFGSR' that will either automatically 'open' the firmware, or if not, you need to go to the 'USB' tab and select it from the list displayed in the bottom box. Which way depends on if you have 'CFGSR' set up to auto connect on program start or not.

> Following configuration with CFGSR, it is adviseable to

$$\frac{2\pi Z_0 H_\Phi^{\,s}(r=a,z)}{ika}=\int_0^g dz' f(z')\Big(K_p(z-z')+K_c(z,z')\Big). \tag{1-12}$$

This equation follows the exact formalism presented by Gluckstern et al. and only includes a minor difference in the form of the source term. Using this particular form of the integral equation will aid in studying realistic and practical geometries of stiff charged particle beams. The function f(z) is the unknown function where $f(z)=E_z(r=a,z)$.

E. Goals

It is the purpose of this work ~~manuscript~~ to further investigate the stretched wire measurement and to present theoretical and experimental conclusions. To date only TM modes were analyzed and this dissertation will include all TM and TEM cavity modes. With the aid of linear system theory, the derivation of a new integral equation will be presented. Furthermore, using the assumption of a particular source distribution, a different method for solving the problem of the interaction of the beam with its environment will be shown using a complex Fourier series approximation for $\vec{E}(r=a,z)\cdot\hat{z}$. With the complex Fourier series approximation, the effects of the coupling structure, namely the beampipe in the case of the physical particle beam or the wire in the case of the stretched wire measurement, can be extracted. Once the effects of the coupling structure are known, an

> use one of the simpler SDR programs for initial testing of RX (and/or TX) functionality, even though you may want to have a more robust piece of software as your ultimate radio.

For further discussions of the software side of SDR and soundcard issues, see Alan G4ZFQ's pages.

Test Local Oscillator

You can use 'CFGSR' to exercise the Si570 using the 'Tune' tab that makes it into a 'VFO'. Just a case of setting the frequency, and the Si570 should output a signal at 4 times the frequency displayed on the main display on the screen. The 'Test' tab can also be used to look at all the various Si570 registers etc, but probably unnecessary as if you can hear or measure the Si570 output frequency, you know it is working.

Check	Designation	Component (top/bottom)	Orientation	Marking	Image	Ba

Configure Si570 for LF Option

For the LF version, it will be essential to change the firmware configuration to successfully operate that version. Tthe default values are only suitable for the 'normal' HF version.

Changes needed are (using CFGSR.exe):

- **Si570 tab**

  set the minimum device frequency to 3MHz (default 6MHz). Although the Si570 will not run below 3.5MHz, the box only accepts integer values

$$H_{\phi}(r=a,z,\omega)=\begin{cases}\dfrac{I_o}{2\pi a}e^{-i\omega\frac{z}{c}}\left(1+\dfrac{4\pi^2\alpha_0 A(\frac{\omega}{c})}{Z_o I_o}\right) & z\geq g\\ \dfrac{2\pi\alpha_0}{a}A(-\frac{\omega}{c})\,e^{i\omega\frac{z}{c}} & z<0\end{cases}.$$

They found the transmission coefficient by substituting the expression for f(z) into $A(\frac{\omega}{c})$

$$T(\omega)=1+\frac{2\pi\alpha_0}{Z_o I_o}\int_0^g f(z)\,e^{i\omega\frac{z}{c}}dz. \tag{1-11}$$

In 1990 Heifets and Kheifets [7] from SLAC wrote a thorough theoretical paper discussing different iterative schemes for finding the beam impedance. Each iterative method is applied to a relativistic point charge interacting with a series of structures such as cavities and steps. They used the same technique of field matching to find the beam interactions and discussed methods of estimating high-order terms.

The final general ϕ independent beampipe, cavity, and beam distribution integral equation which will be used throughout this dissertation is of the form:

- **LO tab**

  need to change the 'LO:Total' multiply for bands 0 - 3 from the default x4 to x16

- **ABPF tab**

  need to change the filter cross over points to 0.4, 0.8 and 1.6MHz

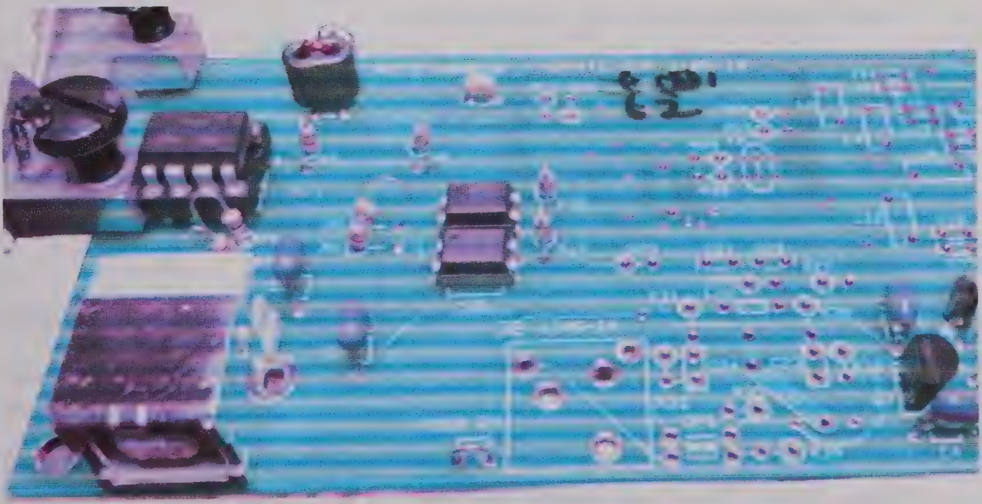
(TX to Bob G8VOI for the instructions on how to configure the Ensemble RX II Local Oscilklator for LF operation.)

Check	Designation	Component (top/bottom)	Orientation	Marking	Image	Ba

}

Completed Photos

View of Completed Topside



View of Completed Underside

the beam impedance Z(k). They concluded that there exists a similarity between

$$\frac{Z(k)}{Z_0} \simeq \frac{1-T(k)}{2\pi\alpha_0}$$

for large k and small obstacles.

Gluckstern and Li found the transmission coefficient by first finding $E_z(r=a,z)$. They then found the scattered magnetic field through the relationship:

$$Z_o H_\phi (r=a,z) = \frac{Z_o I_o}{2\pi a} e^{-ikz} - ik \int_{-\infty}^{\infty} A(q)\, e^{-iqz} J(q)\, dq. \qquad (1\text{-}10)$$

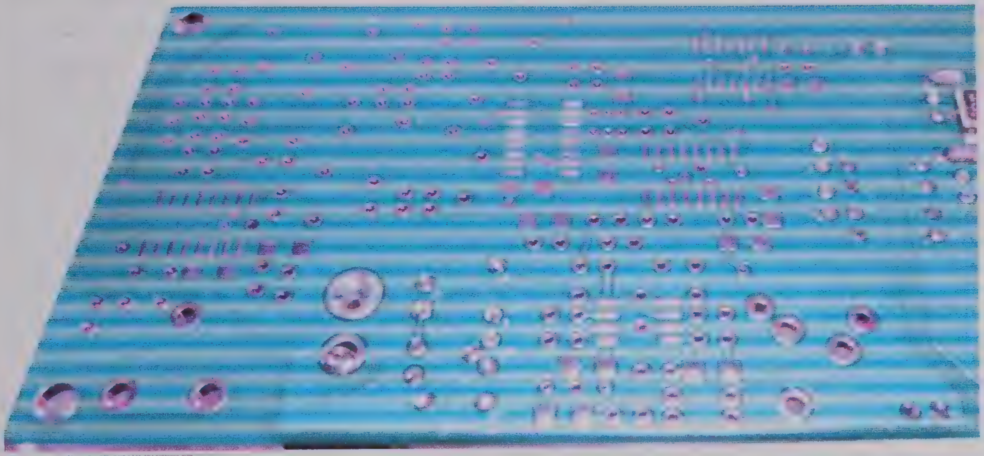
The function A(q) is defined by:

$$A(q) \triangleq \frac{1}{2\pi} \int_0^g f(z)\, e^{iqz} dz$$

and

$$J(q) = -2 \sum_{s=0}^{\infty} \frac{\alpha_s}{q^2 a^2 - \tilde{b}_s^2}.$$

The integration of A(q) in Eq. 1-10 is performed by complex analysis. The s=0 terms relate to the scattered transmitted and reflected magnetic field. The transmitted magnetic field is:



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Test the Local Oscillator and Control Stage

Local Oscillator and Control - Current Draw

Power up the regular circuit side of the board

Measure the current draw on the 12 V power lead (WITHOUT the USB plugged in)

Plug in the USB cable and keep 12V power to the main circuit

Measure the current draw on the 12 V power lead (WITH the USB plugged in). You should get a slightly higher current draw.

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$$K_p(|z-z'|) = \frac{i2\pi}{a}\sum_{s=0}^{\infty}\frac{\alpha_s}{\tilde{b}_s}\, e^{\frac{-i\tilde{b}_s|z-z'|}{a}}, \qquad (1\text{-}8)$$

where the α_s's are defined by

$$\alpha_s = \frac{J_0^2\left(\frac{r_0 i_s}{a}\right)}{J_0^2\left(\frac{r_0 i_s}{a}\right) - J_0^2(i_s)} \quad s \geq 1, \qquad \alpha_0 = \frac{1}{2\ln\left(\frac{a}{r_0}\right)}, \qquad (1\text{-}9)$$

and the i_s's are the solutions to

$$Y_0(i_s)\,J_0\left(i_s\frac{r_o}{a}\right) - J_0(i_s)\,Y_0\left(i_s\frac{r_o}{a}\right) = 0 \qquad s \geq 1.$$

$$i_0 \triangleq 0$$

The axial wave numbers are described similarly by

$$\tilde{b}_s = \begin{cases} \sqrt{(ka)^2 - i_s^2} & i_s^2 < (ka)^2 \\ -i\sqrt{i_s^2 - (ka)^2} & i_s^2 > (ka)^2 \end{cases}.$$

Gluckstern and Li used the same techniques to solve the integral equation as Gluckstern used when he solved the problem of a relativistic charge encountering a pillbox cavity. The final conclusion from Gluckstern and Li concerns the similarity between the transmission coefficient T(k) and

Test Steps (if any)

Step	Test Point	UOM	Nominal	Author's	Builder's
0	Current Draw - NO USB	mA	< 8	4.3	
1	Current Draw - USB plugged in	mA	< 9	5.3	

Go to Top of Page

Local Oscillator and Control - Test T1 Windings

Using an ohmmeter, check for continuity between the right-hand pad for C35 (point marked "A") and the USB ground (point marked "B"). You should get continuity (~ 0 ohms). Then, check for continuity (~ 0 ohms) between the right-hand pad of C35 (point marked "A") and the regular ground (point marked "C"). You should NOT get continuity; if you do get continuity, then you have a short in the windings or you have your windings crossed.

equations:

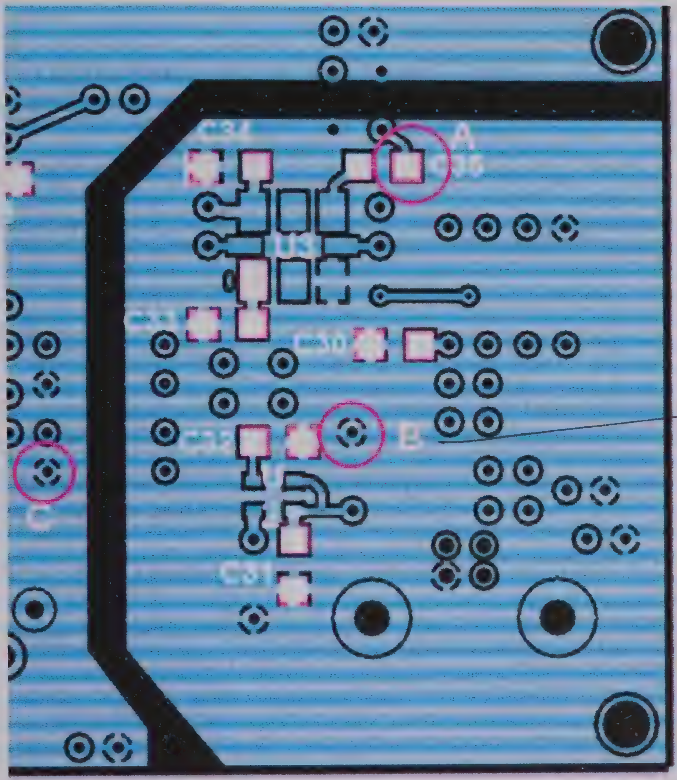
$$\nabla\times\vec{E}_l=k_l\vec{h}_l \qquad \nabla\times\vec{h}_l=k_l\vec{E}_l,$$

where $k_l=\frac{\omega_l}{c}$. Dimensional analysis shows that $\vec{h}_l(r,z)$ has the same units as the electric field. Additionally, $\vec{h}_l(r,z)$ and $\vec{E}_l(r,z)$ have the same normalization:

$$\int_{cavity}\vec{E}_l\cdot\vec{E}_m\,d\tau=\int_{cavity}\vec{h}_l\cdot\vec{h}_m\,d\tau=\delta_{l,m}.$$

Finally, Gluckstern estimated the solution to his integral equation for high frequencies by modifying the kernels into their non-oscillatory components. The infinite summations of the non-oscillatory parts of the kernels can then be changed into integrations which are then easily evaluated.

In 1989 Gluckstern and Li [6] solved the problem of placing a pulse of current on a coaxial wire of radius $r=r_0$ inside a pillbox cavity (see Fig. 1-9). This particular geometry is of ~~particular~~ especial interest since it closely resembles a structure frequently used for estimating the beam impedance. Gluckstern and Li represent their solution in the same form as the integral equation in Eq. 1-5 where K_c, the cavity kernel, is the same as in the problem without the center conductor, while K_p, the pipe kernel, has an obvious difference due to a different beampipe geometry and is changed to:



"B"
USB gnd

Go to Top of Page

Test Steps (if any)

Step	Test Point	UOM	Nominal	Author's	Builder's
1	"A" to "B"	ohms	~0		
2	"A" to "C"	ohms	~ infinity		

Go to Top of Page

Local Oscillator and

and length cause each cavity to have slightly different resonant frequencies. The use of several cavities of slightly different resonant frequencies is used in the design of klystrons for broadband amplification. The summation of different resonant frequencies causes Simpson's experiment to have a broader frequency response than, for example, a single cavity.

A fundamental difference between the experimental data and the theoretical data is an evanescence caused by the use of a practical excitation source. Figure 4-7 illustrates this effect. The definition of beam impedance requires the

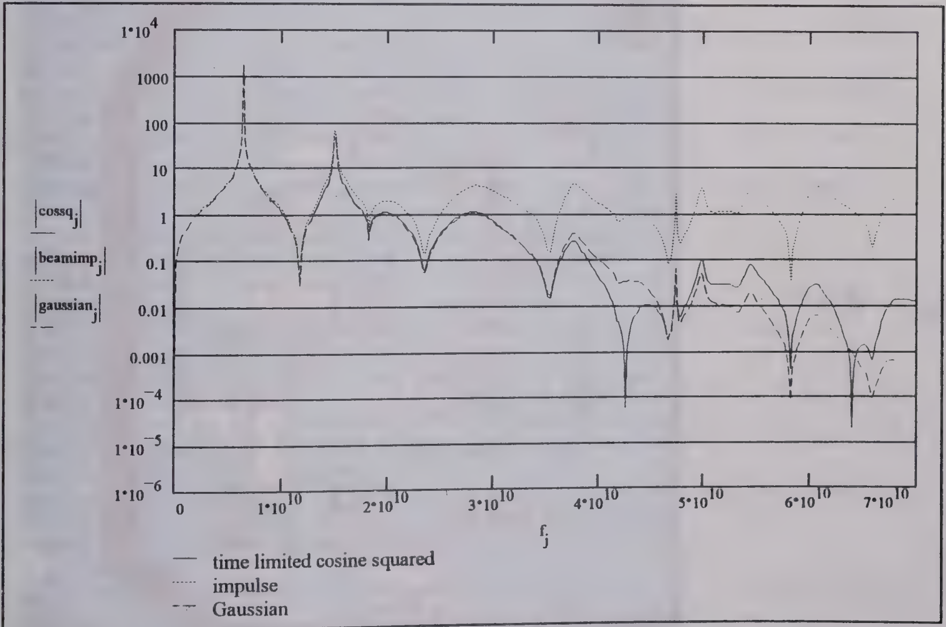


Figure 4-7. Impedances (Ω) caused by different source distributions versus frequency (Hz).

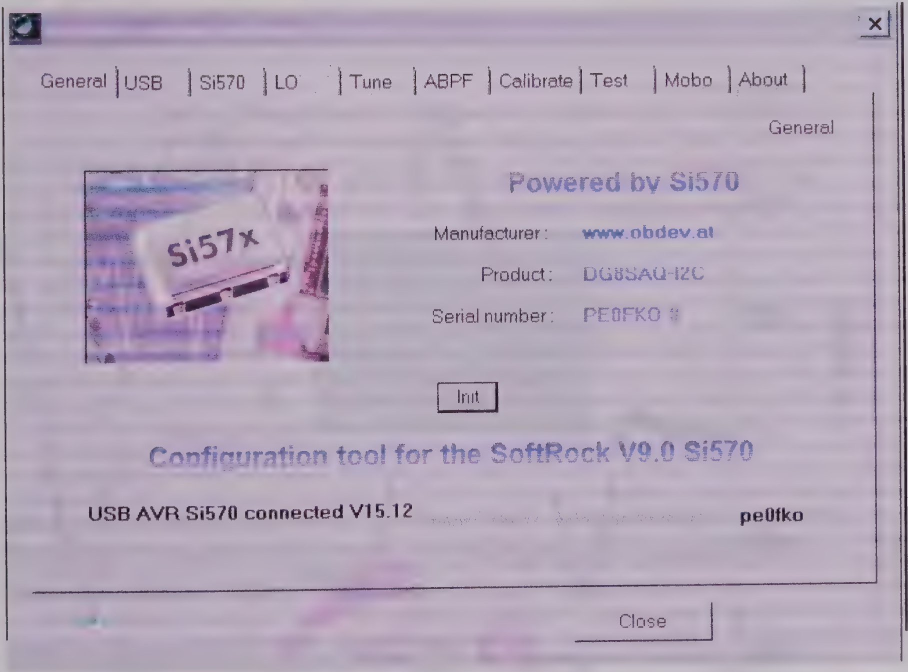
Control - LO Stage Outputs

Here we want to measure the output (4x center frequency for dividers). It is measured WRT (regular) ground (at the R9 hairpion lead).

Setup

Be sure all software and drivers, etc., have been installed. Connect the USB jack via USB cable to the PC. You should hear the "BoopBoop" sound the PC makes when it recognizes a device (the Ensemble) has been attached to a USB port..

Next, run CFGSR.exe and you should get the following screen:



Powered by Si570

Manufacturer : www.obdev.at

Product : DG8SAQ-I2C

Serial number : PE0FKO #

Configuration tool for the SoftRock V9.0 Si570

USB AVR Si570 connected V15.12 pe0fko

Then, check out the "Si570" tab. It should look like this:

considered and the explanations of the measurement and measurement technique were studied. The relative magnitudes and phases between Figs. 4-5 and 4-6 show resonable agreement and provide evidence that the method presented to solve Eq. 1-12 with the complex Fourier series is justified.

Simpson's experiment was comprised of 103 resonant pillbox cavities. Each cavity had to be individually machined and, therefore, each cavity was slightly different from its neighboring cavities. Minute differences in radii

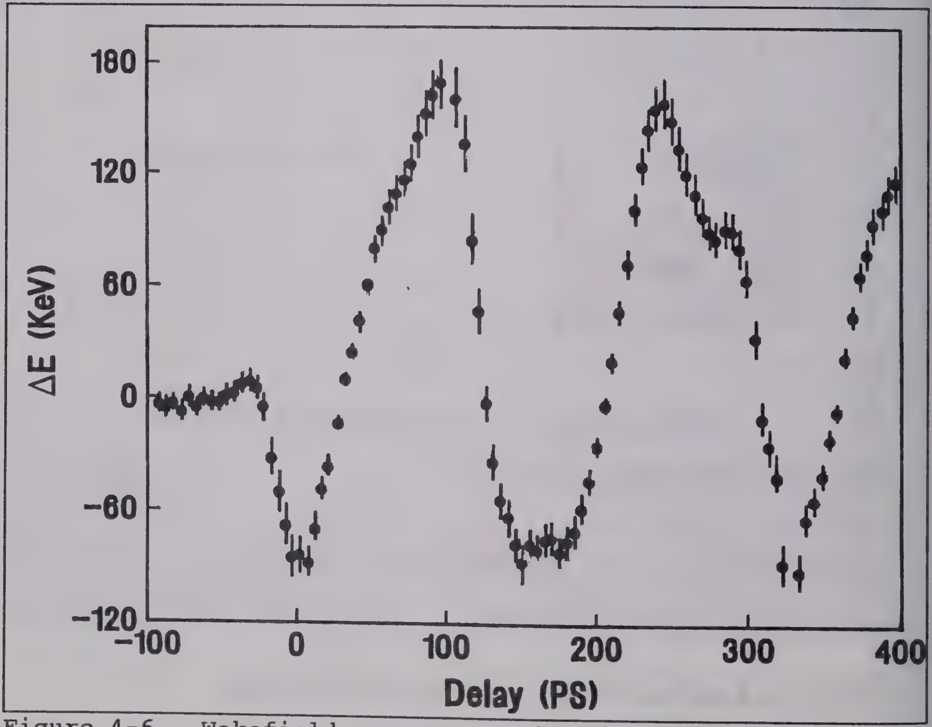
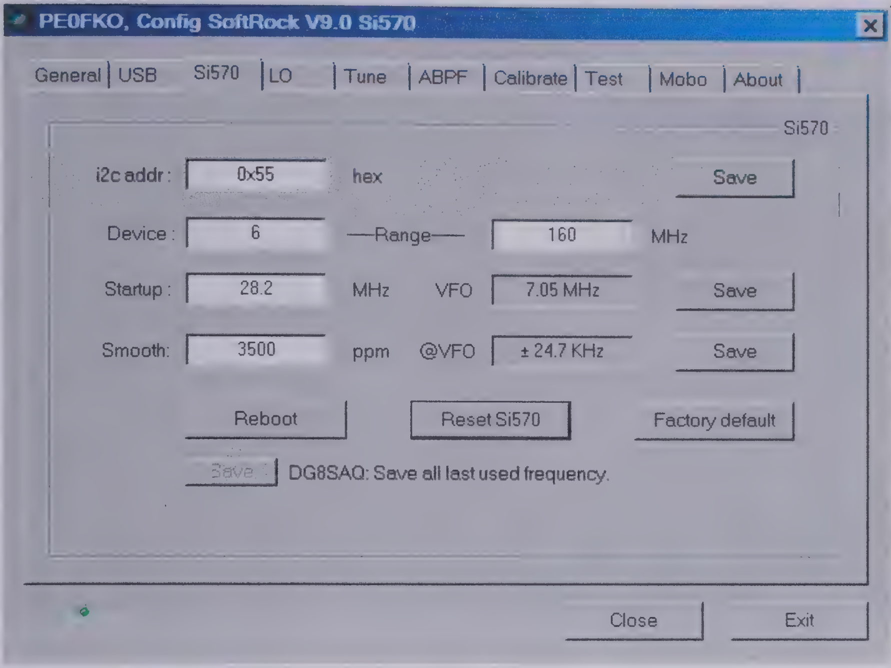


Figure 4-6. Wakefield measurement by Simpson et. al. [12]


PE0FKO, Config SoftRock V9.0 Si570

i2c addr : 0x55 hex

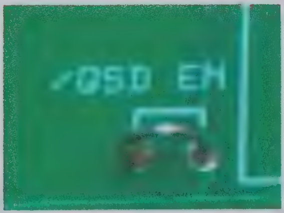
Device : 6 —Range— 160 MHz

Startup : 28.2 MHz VFO 7.05 MHz

Smooth: 3500 ppm @VFO ± 24.7 KHz

DG8SAQ: Save all last used frequency.

Note that the Local Oscillator's outputs are measured with respect to the analog ground plane, NOT with respect to the galvanically isolated USB groundplane. The /QSD EN shunt is a good point for this ground connection.

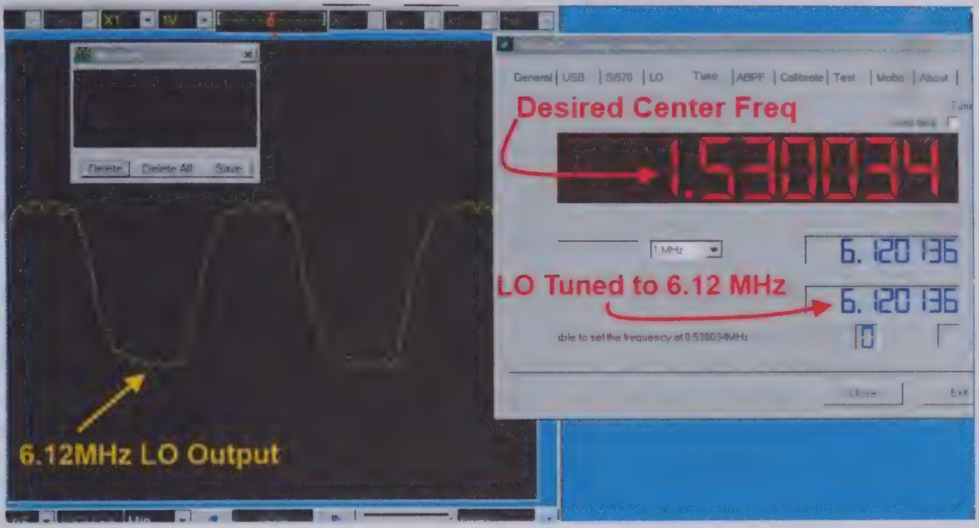


Using the CFGSR Software (at the "Tune" tab), test scenarios for setting the center frequency (remember, the Si570 produces a signal that is 4 times the desired center frequency).

Measure the output at the hairpin lead of R9.

Below is an example of tuning the Si570 in CFGSR, selecting a center frerquency of 1.53 MHz (with an Si570 output frequency of 4x, or 6.12MHz. (Pay no attention to the lousy oscilloscope behind the curtains -

the output is really a square wave, but the scope is a cheap USB scope that doesn't sample HF square waves very well.)



You can place your mouse on the frequency in the center frequency field and turn your mouse wheel. The center frequency will increase or decrease and the LO Output frequency (4x) will increase or decrease at a rate 4 times that of the center frequency.

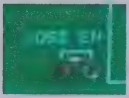
John, KB6QL, discovered this trick for those with no scope, counter, or HF radio to use in testing LO output:

"Turns out that local oscillator can be tuned for a frequency that is in the FM band. So, as a quick and dirty, I got out my little MP3 player-cum-FM-radio and tuned it to that frequency and let the headset cord/ant drape over the RX. It gave me full quieting. Then I switched the RX to another frequency and the quieting was gone."

Troubleshooting Hints

If the Si570 is not receiving any good I2C signals it will start at 56.32MHz. If it is controlled, 28.2. And the Test tab of CFGSR should be filled with data.

Using Wrong Ground



When making measurements on the analog side, you must use the analog ("regular") ground plane - the /QSD-EN is a good ground connection point.

USB Device Not Recognized

If your computer does not recognize the ATTiny 85 (USB) device, the cause could be either hardware or software. If you find yourself getting into a "loop" trying to install the USB driver/device, then pop over to Alan G4FZQ's great site and read his excellent page dealing with this and related issues. Hardware-related causes are often traced back to the resistors and/or diodes installed in the USB section or to improper installatin/insertion of the ATTINY-85 microprocessor,

Hardware

Check the resistors (R1-R4) and make certain they are the correct value

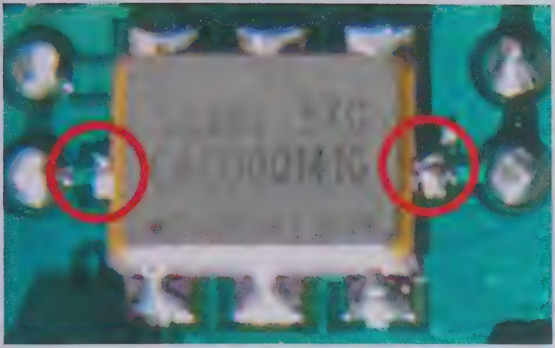
Check the alignment and placement of U1 and make sure it is snugly fitting in the socket. It is easy to accidentally bend one or more of the pins when inserting the chip into the socket.

Software

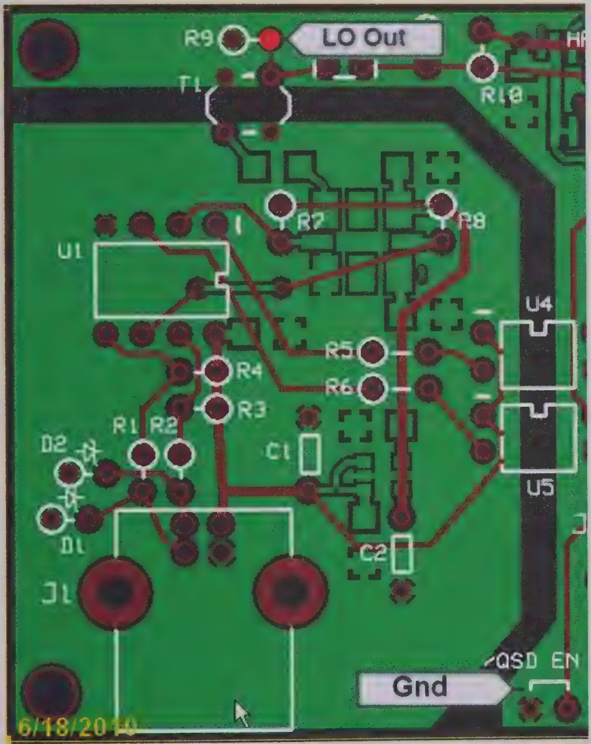
Review the WB5RVZ software "schematic" and then:

Check out Alan G4ZFQ's great webpage on Si570/ATTiny85 issues.

Si570 Does Not Respond to Control Signals



Soldering on the Si570 is the most usual problem with lack of control, providing the USB is properly recognised.



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Test Steps (if any)

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Local Oscillator and Control - Validate Filter Selection Outputs

With power applied to the 12V bus and to the USB bus:

Start up CFSR again and tune the local oscillator through four frequencies (each being in the middle of one of the bands):

1. 2MHz
2. 6MHz
3. 12MHz
4. 24MHz

Measure the voltages at "FL SEL 0" (R13 hairpin) and "FL SEL 1" (R12 hairpin) with respect to regular ground

(The high/low values at R12 and R13 are used in the ABPF switching truth table, shown in the Automatic Band Pass Filter stage's introductory paragraphs.

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Test Steps (if any)

Step	Test Point	UOM	Nominal	Author's	Builder's
1	R12 (for 2 MHz band 0)	Vdc	0	100 mV	
3	R12 (for 6 MHz	Vdc	0	100 mV	

5	R12 (for 12 MHz band 2)	Vdc	5	4.92	
7	R12 (for 24 MHz band 3)	Vdc	5	4.92	
12	R13 (for 2 MHz band 0)	Vdc	0	100 mV	
14	R13 (for 6 MHz band 1)	Vdc	5	4.92	
16	R13 (for 12 MHz band 2)	Vdc	0	100 mV	
18	R13 (for 24 MHz band 3)	Vdc	5	4.92	

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Next Stage: Dividers

WB5RVZ.Org - Ensemble HF/LF RX II

Ensemble RX II (HF/LF) Quadrature Clock Generator Band: LF

Introduction

Band Specific Components

This stage involves band-specific components and is currently configured for the LF band. If you need to configure this page for a different band, click on the "Band" tab in the menu above. This would take you to the home page, where you can select the new band and then return to this page.

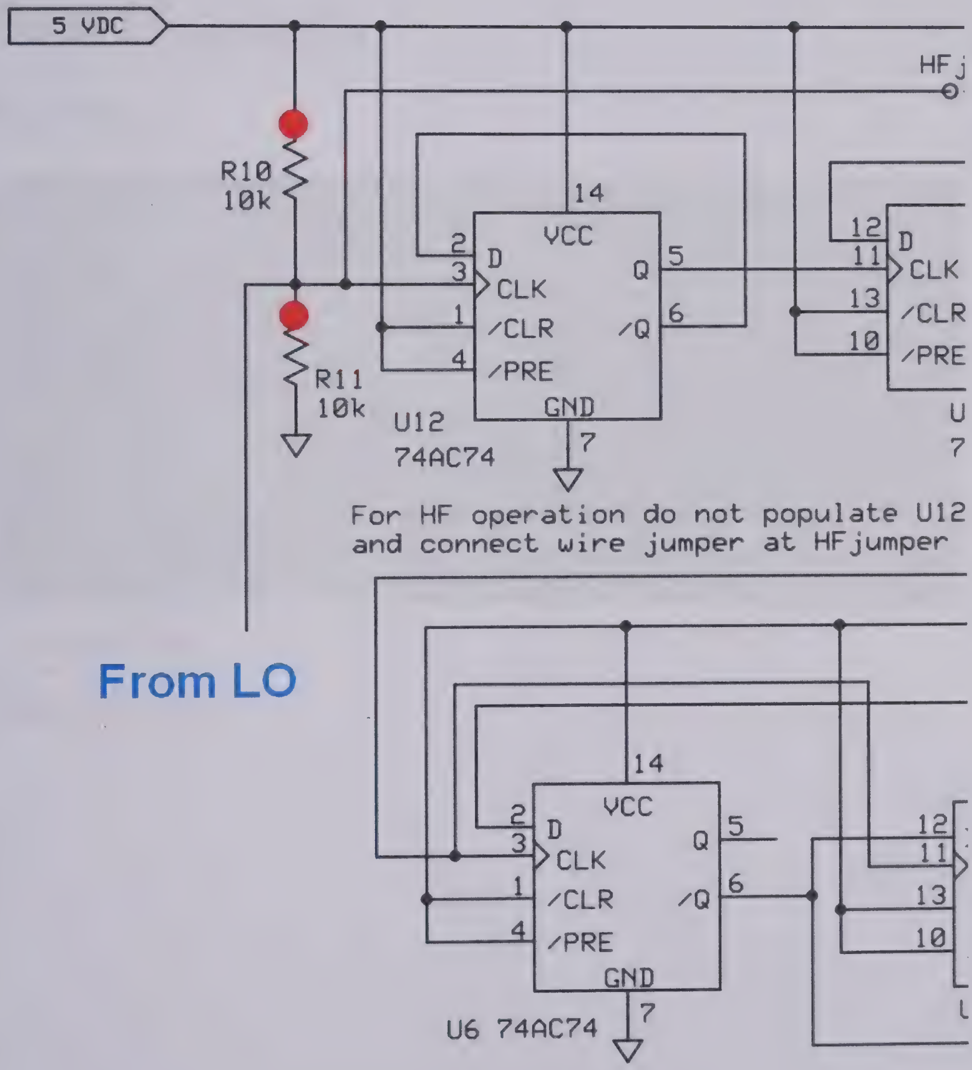
General Info About the Stage

This stage divides the local oscillator output by 4 and shifts the phase of the dividend signals such that they are now one-fourth the LO frequency and 90 degrees separated in phase (i.e., in quadrature). Both signals are identical in all regards except phase.

They will be used to clock the switch used in the Quadrature Sampling Detector (QSD) stage.

Theory of Operation

Stage Schematic



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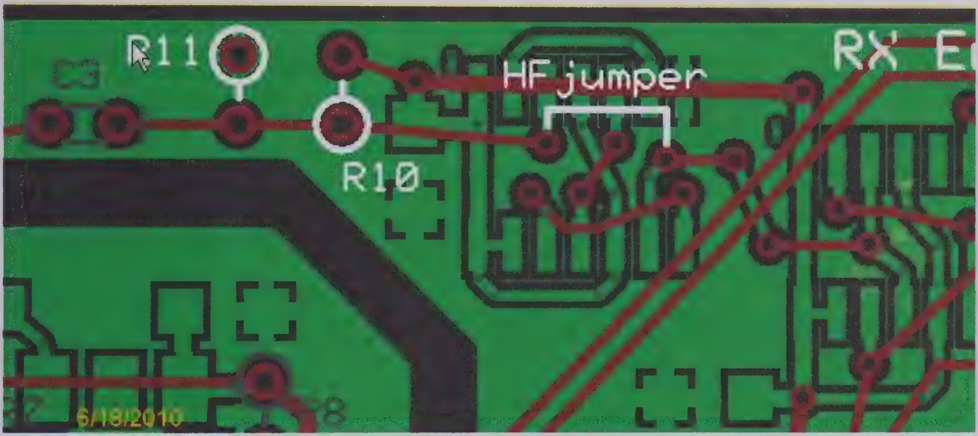
Click here for full schematic

(Red dots represent the "hairpin" (or left-hand or topmost) lead of the component)

Board Layouts

Board Top



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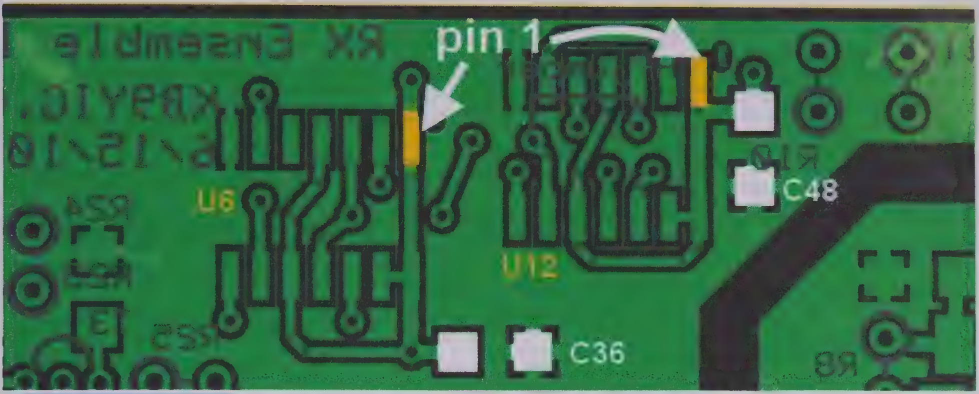
Board Bottom



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Summary Build Notes

1. Install Voltage Divider Resistors
2. Install ICs and SMT Capacitors
3. Install HF Jumper
4. Test the Stage

Quadrature Clock Generator Bill of Materials (LF band option)

Check	Type	Category	Component	Count	Marking
☐	Band-specific	Omit	omit for this band	1	
☐	Capacitor	SMT 1206	0.1 uF	2	(smt) black stripe
☐	IC	SOIC-14	74AC74 Dual D FF	2	74AC74 ESD!!!

☐	Resistor	1/6W	10 k 1/6W 5%	2	brn-blk-ora-gld

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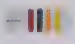
Detailed Build Steps

Install Voltage Divider Resistors

Pay careful attention to the orientation (S-N and N-S, respectively) of R10 and R11. Some builders have inadvertently installed these with a horizontal orientation rather than a vertical orientation.

Check	Designation	Component (top/bottom)	Orientation	Marking	Image
☐	R10	10 k 1/6W 5% (top)	S-N	brn-blk-ora-gld	
☐	R11	10 k 1/6W 5% (top)	N-S	brn-blk-ora-gld	

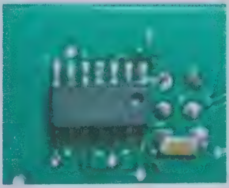
Install ICs and SMT Capacitors

Here, you will install U6 (to get a divide-by-4) and, if building the LF option, U12 (to get a divide-by-16); also installed will be the appropriate SMT bypass capacitors.

U6 is required for both HF and LF options; U12 is only needed for the LF option. Watch out for the potential to install U6 in the wrong set of pads!

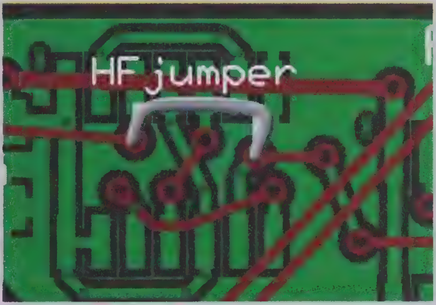
Note: the completed photos do not show U12 AND U6; they were taken of the earlier HF-only build and, thus, only show U6 installed.

A common mistake is installing U6 (and/or U12) incorrectly. The chips are installed such that their pin 1 is aligned with the upper right-hand pin (when viewing the bottom of the board such that the Si570 is on the right).

Check	Designation	Component (top/bottom)	Orientation	Marking
☐	C36	0.1 uF ((bottom))	white pads	(smt) black stripe
☐	C48	0.1 uF ((bottom))	white pads	(smt) black stripe
☐	U06	74AC74 Dual D FF ((bottom))		74AC74 ESD!!!

☐	U12	74AC74 Dual D FF ((bottom))		74AC74 ESD!!!

Install HF Jumper



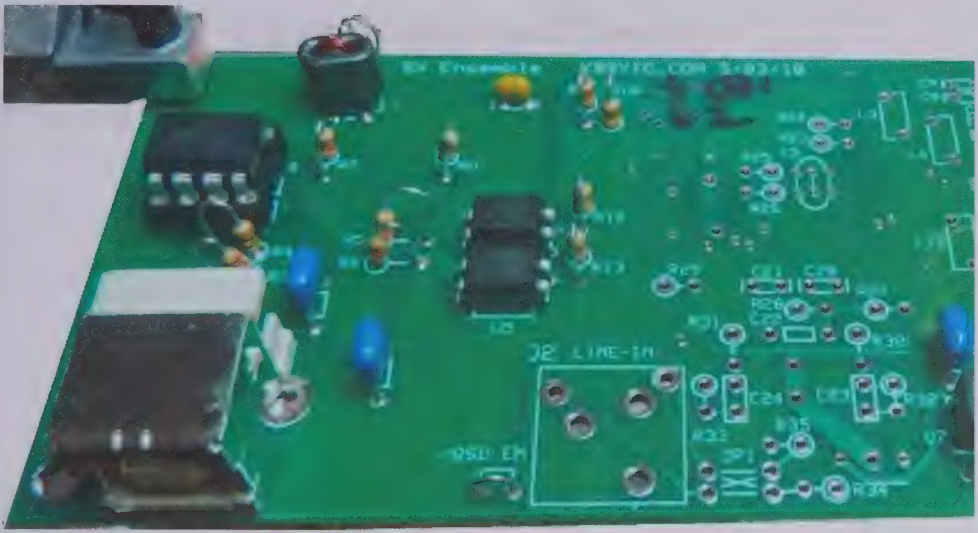
If building the HF option, omit U12 and Install the jumper wire to bypass U12 with the LO signal

Check	Designation	Component (top/bottom)	Orientation	Marking	Image
☐	hf-jmp	omit for this band (top)			

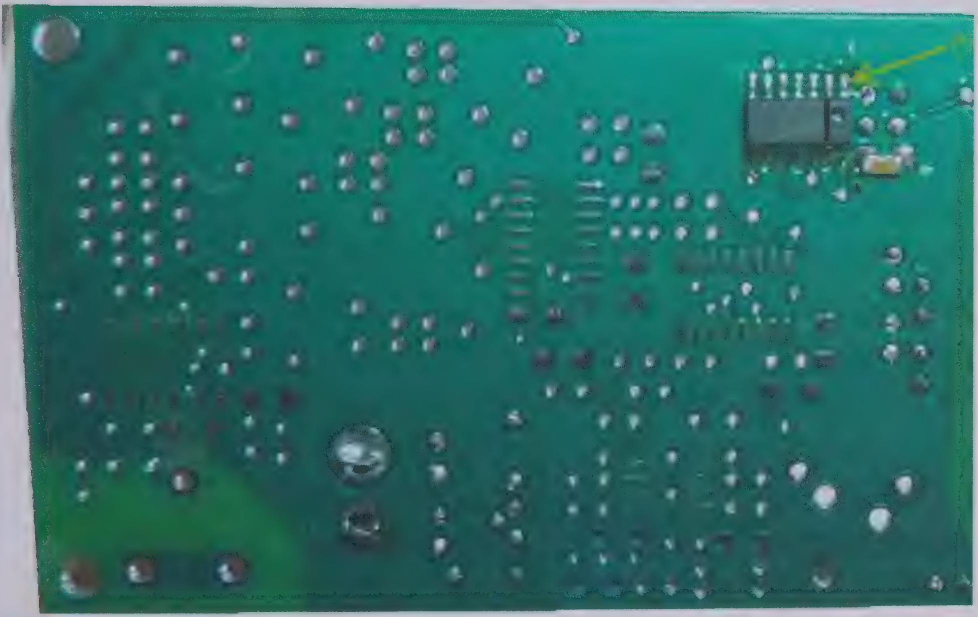
Completed Photos

View of Completed Topside

Completed Photo



View of Completed Underside



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[illegible]

[illegible]

Test the Quadrature Clock Generator Stage

Quadrature Clock Generator - Current Draw

With both the USB cable and the power cable plugged in, measure the current draw in the positive power lead.

Measure the current draw with just the 12V power.

Note: the current draw will be slightly higher if you installed U12 as part of an LF option build

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Test Steps (if any)

Step	Test Point	UOM	Nominal	Author's	Builder's
0	Current draw WITH USB	mA	< 18	9.8	
1	Current draw NO USB	mA	< 20	13.7	

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Quadrature Clock Generator - Test Voltage Divider

When performing the following tests, you must apply [pwer to the board AND plug in the USB cable. Otherwise, results will not be as expected.

Plug in USB and power the board.

Measure the voltage on the R11 hairpin; you should see 50% of the %v rail voltage.

Depending upon your DMM, your measurements may vary. What we are looking for here is roughly half the 5 volt rail.

Troubleshooting the Voltage Divider

If you do not get the expected R11 value you expect, the possibilities are most likely that you have a short or you have mounted the wrong resistor value(s). For the latter case, you may want to use the utility Voltage Divider Calculator to enter your actual R11 value (Vout and see what resistance values might produce that voltage.

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Test Steps (if any)

Step	Test	UOM	Nominal	Author's	Builder's

	band 1)				

	Point				
0	R11 hairpin (WRT regular gnd)	V dc	2.5	2.46	

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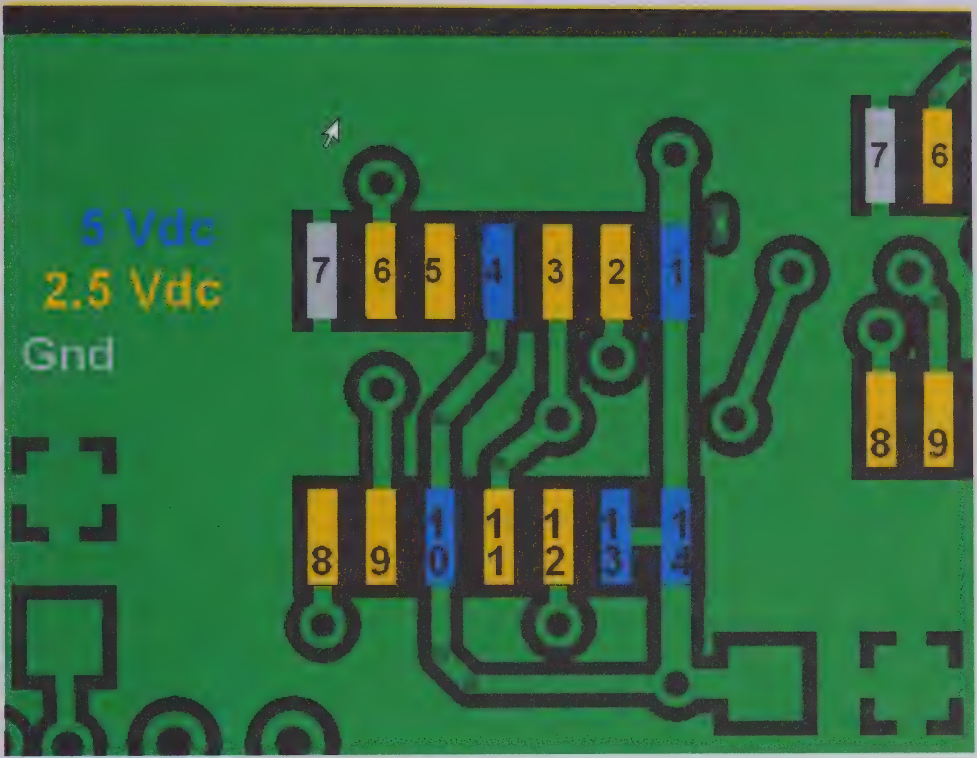
Quadrature Clock Generator - Divider Pin Voltages

Power USB and 12V. Then measure the voltages on the pins (and, separately, on the pads) of U6 (74AC74). Refer to the color codes on the graphic for the voltages.

Pins 3 and 11 will not show exactly 2.5Vdc because they have the additional AC component of the local oscillator signal from C3. The important idea is - for those pins which should nominally be 2.5Vdc - you do NOT want to see 0 or 5 Vdc!

If you are building the LF option, you should perform this test on both U12 and U6; otherwise, just test U6.



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Test Steps (if any)

Step	Test Point	UOM	Nominal	Author's	Builder's
1	Pin 1	Vdc	5	4.92	
2	Pin 2	Vdc	2.5	2.45	
3	Pin 3	Vdc	2 to 3	2.46	
4	Pin 4	Vdc	5	4.92	
5	Pin 5	Vdc	2.5	2.45	
6	Pin 6	Vdc	2.5	2.45	
7	Pin 7	Vdc	0 (GND)	0	
8	Pin 8	Vdc	2.5	2.45	
9	Pin 9	Vdc	2.5	2.45	
10	Pin 10	Vdc	5	4.92	

5
0
2.5
5
5
0
0
0
0
5

11	Pin 11	Vdc	2.5	2.46		2.5
12	Pin 12	Vdc	2 - 3	2.45		0
13	Pin 13	Vdc	5	4.92		5
14	Pin 14	Vdc	5	4.92		5

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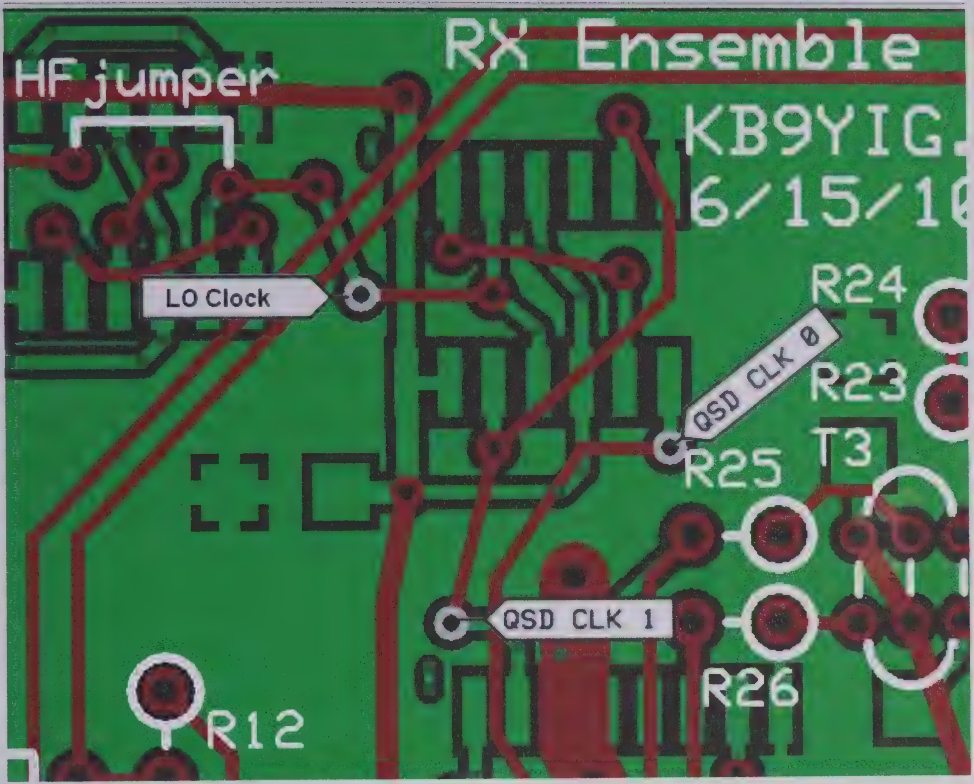
Quadrature Clock Generator - Quadrature Colck Generated Waveforms

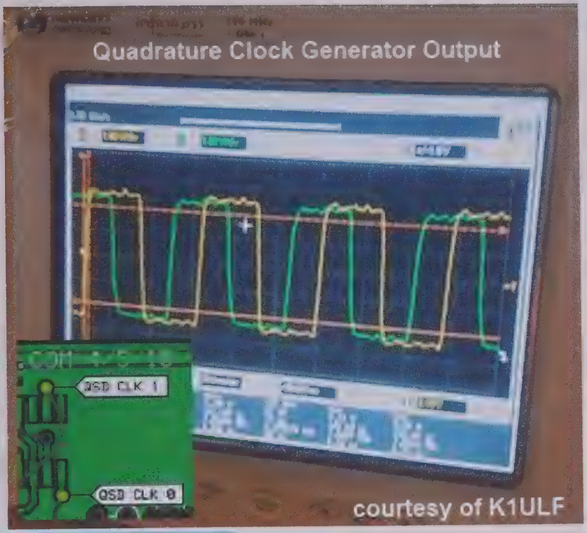
Set your board up to oscillate at a selected center frequency, e.g., 7.100 MHz.



If you have a dual trace scope available, probe the two "QSD CLK (n)" test points and you should get a waveform similar to the one shown here.

The testpoint marked "LO Clock" will provide the Si570's output frequency or, in the case of the LF option, that frequency divided by 4 (courtesy of U12).

Your mileage may vary, depending upon the desired center frequency you select and the quality of your scope (some scopes tend to have issues with these square waves - still, the scope should show two waveforms in quadrature at the desired center frequency).


Quadrature Clock Generator Output

courtesy of K1ULF

2 & 9
6 & 12

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Test Steps (if any)

Go to Top of Page

Next Stage: Band Pass Filters

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WB5RVZ.Org - Ensemble HF/LF RX II

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Op Amps BOM BOM X-Ref Inventory Revisions as of 6/20/2013
WB5RVZ

Ensemble RX II (HF/LF) Auto Band Pass Filters

Band: LF

Introduction

Band Specific Components

This stage involves band-specific components and is currently configured for the LF band. If you need to configure this page for a different band, click on the "Band" tab in the menu above. This would take you to the home page, where you can select the new band and then return to this page.

General Info About the Stage

This stage implements the automatic bandpass filtering circuit. The circuit uses two quad multiplexer switches to switch one of four bandpass filters into the QSD input. The filters provide continuous coverage, in four "chunks", from 1.8MHa through 30 MHz in the HF option and 0.180 MHz to 3.0 MHz in the LF option (with some under and overlaps).

Switching is automatic, via the two binary signals, "FL SEL 0" and "FL SEL 1". The ATTiny 85 Microcontroller has a built-in band plan (which the user can adjust, using the facilities in the CFGSR program) which associates any output frequency of the Local Oscillator to the most appropriate filter and issues the corresponding bits to "FL SEL 0" and "FL SEL 1", per the following truth table:

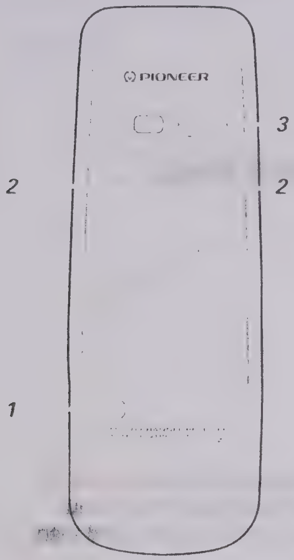
Filter Selection Truth Table

(Frequencies in the Low/High columns are given for the HF option, with the frequencies for the LF option shown inside of parentheses).

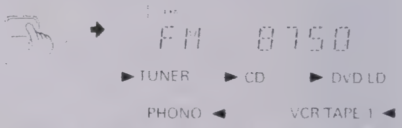
L is a voltage less than 200 mV; H is a voltage greater than 3 V

Sel 1 (R12)	Sel 0 (R13)	Band	Low HF (LF) MHz	High HF (LF) MHz

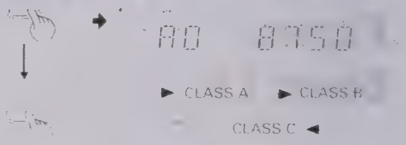
Listening to Memorized Stations



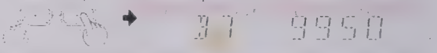
1. Set the TUNER function.



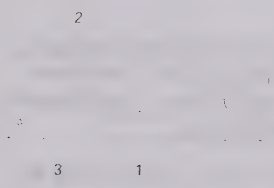
2. Select the CLASS number in which the desired station is memorized. (Before operating, press the TUNER button of the remote control unit.)



3. Select the station number of the desired station. Can also be called with the number button.



Example:
When FM99.50 MHz has been memorized in channel 7 of CLASS B.

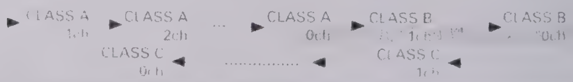


■ Operating with the main unit

1. Press the FM/AM button.
2. Press the CLASS button, and select the CLASS number in which the desired station has been memorized.
3. Press the STATION –, +button, and select the desired station number which has been memorized.

memo

- When the power cord of the unit is disconnected from the wall outlet for several days, the stations memorized will be erased.
- When selecting the station number with the STATION –, + buttons, the stations will switch as follows.



■ Last Station Memory

By turning ON the power and setting TUNER, the station set before the power was turned OFF will be received.

R12	R13	Band	HF(LP)	
L	L	0	1 (0.180)	4 (0.480)
L	H	1	4 (0.400)	8 (0.800)
H	L	2	8 (0.800)	16 (1.6)
H	H	3	16 (1.6)	30 (3.0)
			lower freq	upper freq

(SEL-0 is at the hairpin lead of R13; SEL-1 is at the hairpin lead of R12)

These notes detail the construction of each of the four bandpass filters, with a simple continuity test at the end of each filter's construction to verify soldering of the leads of the coils.

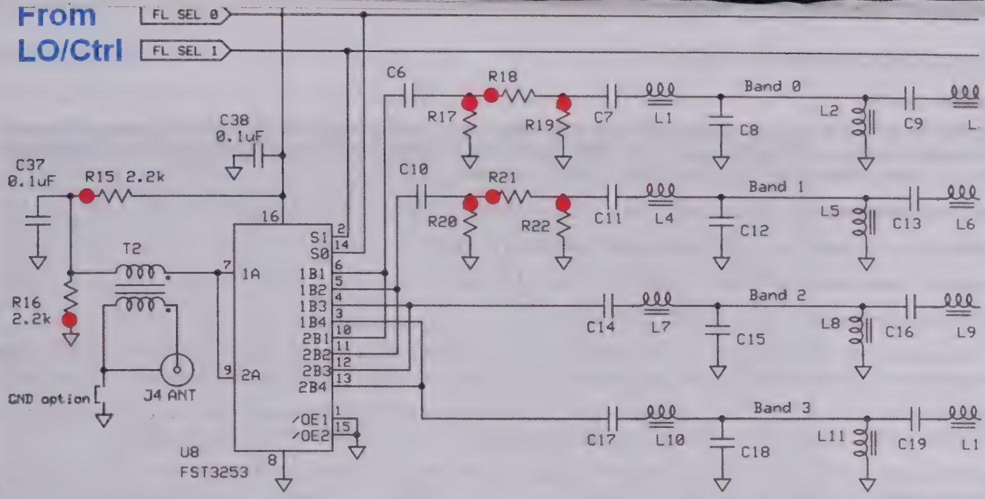
If you are unfamiliar with toroid and binocular inductor construction, please see the WB5RVZ Construction hints for inductors.

(Note: completed photos of this and the next stage were, unfortunately not taken at stage-end. The completed photos shown are from the final stage, with the uninstalled sections photoshopped out. Apologies.)

Theory of Operation

Stage Schematic

om: Bike Registration <bikereg@cityofmadison.com>
ect: **Bicycle Renewal Return Address**
ate April 21, 2010 10:13:11 AM CDT
To: "'1christoph@charter.net'" <1christoph@charter.net>, "'1wilkosz@tds.net'" <1wilkosz@tds.net>, "'21schams@chorus.net'" <21schams@chorus.net>, "'2ca1dw311@charter.net'" <2ca1dw311@charter.net>, "'3javids@charter.net'" <3javids@charter.net>, "'3lukens@sbcglobal.net'" <3lukens@sbcglobal.net>, "'5days@charter.net'" <5days@charter.net>, "'5schaefers@sbcglobal.net'" <5schaefers@sbcglobal.net>, "'6myers2@wisc.edu'" <6myers2@wisc.edu>, "'a.braund@sbcglobal.net'" <a.braund@sbcglobal.net>, "'a.horwitz@comcast.net'" <a.horwitz@comcast.net>, "'a_klimt_girl@hotmail.com'" <a_klimt_girl@hotmail.com>, "'a1chief1c@msn.com'" <a1chief1c@msn.com>, "'aanett@execpc.com'" <aanett@execpc.com> "'aaronsprang@tds.net'" [illegible] "'abblazer95@charter.net'" <abblazer95@charter.net>, "'abbott@primate.wisc.edu'" [illegible] <abcapper@yahoo.com>, "'abeckett@wrn.com'" <abeckett@wrn.com> [illegible] "'acidwashedpants@gmail.com'" [illegible]



6/18/2010

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Click here for full schematic

(Red dots represent the "hairpin" (or left-hand or topmost) lead of the component)

Board Layouts

Board Top

By signing this form, the account owner(s) authorize the redemption of fund shares as set forth above. Shares will be redeemed wh
DWS Investments Service Company receives this form in good order. If acting in a special capacity (executor, administrator, custodi
trustee, corporate officer, etc.), the capacity (title) must be indicated.

Signature guarantees— A signature guarantee is required under the following circumstances:

- Mailed to an address other than the address listed on the account
- Mailed to an address that has changed within the past 15 days
- If the check redemption proceeds exceed $100,000
- If you are signing in your capacity as a custodian, executor, administrator, trustee, or guardian, and are not listed in the accoun registration. Legal documentation verifying capacity is also required, please call Shareholder Services for more information.
- If you are signing in capacity as a corporate officer, and the redemption privilege does not pre-exist on the account. Legal documentation verifying capacity is also required, please call Shareholder Services for more information.

A signature guarantee is issued by a bank or other financial institution to verify and ensure the legitimacy of a signature. An officer
institution will ask for identification to be sure that you are, in fact, the person identified on this form and signing it. He or she will a
stamp verifying that this step has been taken.

- DWS accepts both Medallion Guarantee and non-Medallion signature guarantee stamps.
- All account owners must sign this request.
- We must receive an original stamp.
- If more than one signature is required, one stamp is needed for each signature.
- A notary public is not an acceptable guarantor.

Affix signature guarantee or Medallion Guarantee stam
(if required)

Signature

Title (if applicable)

Date (MM/DD/YYYY)

Affix a second signature guarantee or Medallion Guaran
stamp (if required)

Signature

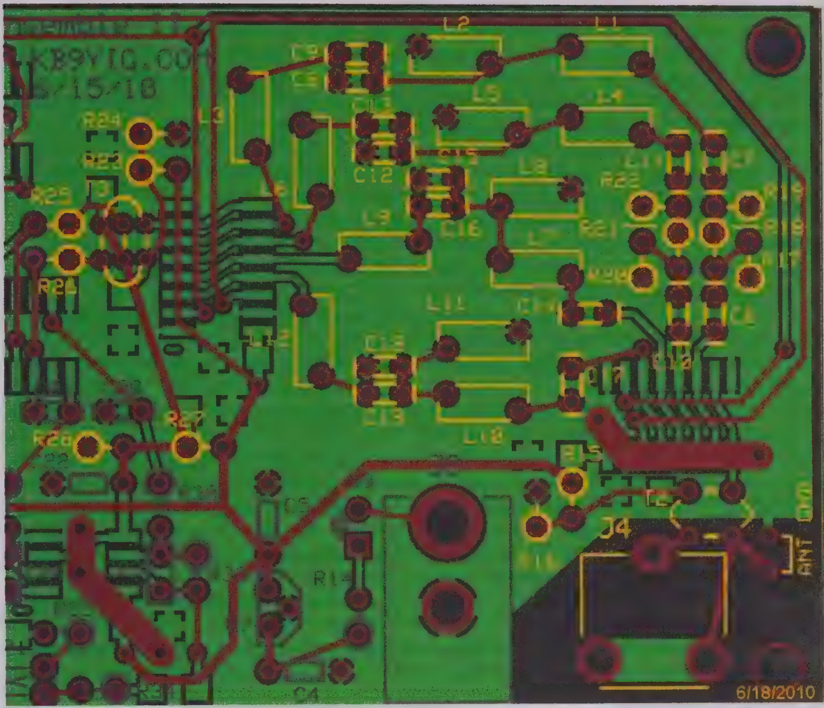
Title (if applicable)

Date (MM/DD/YYYY)

Please mail completed form to:
DWS Investments Service Company
P.O. Box 219151
Kansas City, MO 64121-9151

Overnight address:
DWS Investments Service Company
210 W. 10th St.
Kansas City, MO 64105

DWS Investments Distributors, Inc.
222 South Riverside Plaza, Chicago, IL 60606-
www.dws-investments.com



Board Mo
6/20/2013

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Board Bottom

- Good quality pasta dietary protein source
- Tofu sources of high quality proteins
- Essential protein intakes daily
- What food are richest in Vitamin B1
- Foods that are rich in B Vitamins
- What foods are the richest in Niacin B3
- What kind of foods are rich in Vitamin B6
- What sort of food products rich in Vitamin B12
- Bananas & their nutritional benefits
- Benefits of including fruit in diets
- Benefit to eating many fresh vegetables
- Blackcurrants and their dietary benefits
- Benefit to eating lots of Apples
- Cherry nutritional benefits in the diet
- Good benefits to eating grapefruit every day
- What good benefits come from drinking lots of water
- Body weight & effects of sodium intakes
- Desserts with a low calorie content
- Frequent common questions about foods
- What are fruit calorie contents
- The calorie contents of different vegetables
- How many calories in meat proteins
- What are the calories in fresh Fish
- Number of calories in milks & dairy produce
- What are the calories in cheese & spreads
- The number of calories in egg recipes
- How many calories are in nuts & seeds
- Alcoholic drinks & their calorie contents
- Butter calories each portion of low-fat spread
- The number of calories in beans & peas
- How many calories in rice products
- The number of calories in Tofu products
- The number of calories in sirloin Steak
- How many calories in streaky bacon
- Negative Calories can cause weight loss
- Recipes providing fewer dietary calories
- Low-calorie new easy-to-make desserts
- Low-Calorie soups quick to make
- Lots recipes easy to make & quick
- How to count your food calories
- Calculate calorie needs each day
- Muscle fibers help burn off energy
- Tools to Calculate Calorie needed daily
- How to Measure the calories in Foods
- Glycemic Index way of dieting to lose weight
- Grain products & pastas & glycemic index values
- List of Glycemic values for Legumes Beans
- Sugar substitutes Added different Foods
- Problems using Sweetener & additives in foods
- Spices to help boost metabolism
- Change Sweet tooth & Taste Buds
- Fast foods & common nutritional facts
- Junk Food intakes & links obesity problem
- Bad fat food choices in restaurant menus
- Dieting successfully correct Portion Sizes
- Foods for losing weight in the diet
- A tip when creating shopping lists
- Adapting to problem of over-eating food
- The trouble with Prada-willi Syndrome
- Tackling eating disorders like Bulimia
- What is the problem & signs of Anorexia
- What should I eat during pregnancy
- What to eat right after being pregnant
- Benefits of eating small meals regularly
- What is good timing eat meals during the day?
- The best way to weigh dieting food portions
- Alternative to eating wheat in the diet program
- Healthy dietary fiber intakes in diet
- Problems with alcohol & losing weight
- Choice of foods to help lose weight
- Healthy recipes which are low in fat content
- What are potato chips & good diet benefits
- Quick prepare soups with low calories
- How to convert grams to ounces into grams
- Number of calories in various types of foods
- How many calories are there in different foods?
- The common content of calories in food products
- What are some of the highest calorie foods in diets
- A big full list of the calories in foods product
- Show a free food calorie counter
- Different common foods all with low calories
- What foods should be stocked in cupboards at home
- Eating fruit better than drinking fruit juice?
- Fat content in lean chicken breasts?
- Fat contents in McDonalds fast food products
- Fat content in lean beef fats
- What are the bad & good fats in diet?
- Intake of carbohydrates in the daily diets
- Alcohol & its carbohydrate levels
- Our site map of articles on foods & diets

All tools and information on this site are intended as an aid to help healthy adults lose weight and not intended as medical advice. The information presented here is not for pregnant or breast-feeding women or for any person under the age of 18. If you suffer or think you may suffer from any medical condition you should **consult your doctor** before starting any weight loss exercise regime. Any weight loss exercise programs or diet should be started slowly and we advise you to always consult your doctor or physician beforehand. The information on this page may NOT be accurate, therefore you should NOT take any of the content as a source of reference for any reason whatsoever! You are responsible for comparing the information with an accurate source before using any, or part of this content.

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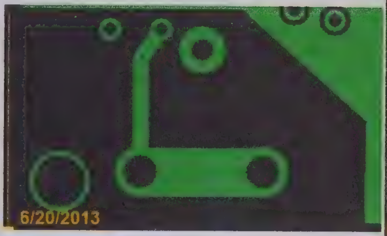
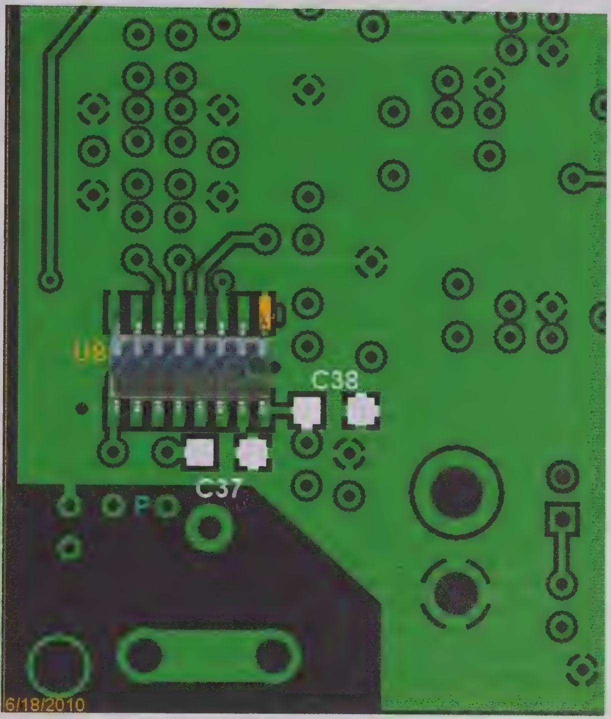
6/20/2013
Board Mod





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Summary Build Notes

1. Install BPF In/Out Components
2. Install and Continuity Test the Band 0 BPF
3. Install the Band 0 Inductors
4. Install the Band 0 Static Components
5. Install and Continuity Test the Band 1 BPF
6. Install the Band 1 Inductors
7. Install the Band 1 Static Components
8. Install and Continuity Test the Band 2 BPF
9. Install the Band 2 Inductors
10. Install the Band 2 Static Components
11. Install and Continuity Test the Band 3 BPF
12. Install the Band 3 Inductors
13. Install the Band 3 Static Components
14. Install Bottomside Components
15. Install Antenna Jack
16. Test the Stage

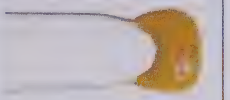
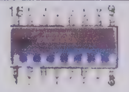
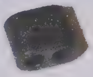
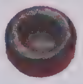
Auto Band Pass Filters Bill of Materials

Comments

- **rlydia said**

on 6/10/2009 I had forgotten about not making a double batch. Thanks for the reminder.

(LF band option)

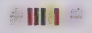
Check	Type	Category	Component	Count	Marking	Image
☐	Band-specific	Omit	omit for this band	4		
☐	Capacitor	Ceramic	0.015 uF 5%	2	153	
☐	Capacitor	Ceramic	1000 pF 5%	2	102	
☐	Capacitor	Ceramic	1800 pF 5%	2	182	
☐	Capacitor	Ceramic	3300 pF 5%	3	332	
☐	Capacitor	Ceramic	6800 pF 5%	3	682	
☐	Capacitor	SMT 1206	0.1 uF	6	(smt) black stripe	
☐	connector	Jack	BNC Connector Male - PCB mount	1		
☐	IC	SOIC-16	FST3253 mux/demux switch	2	FST3253 ESD!!!	
☐	inductor	Binocular core	BN-43-2402 (no markings!)	2	none	
☐	Inductor	Toroid	T30-2 toroid core	9	red	
☐	Inductor	Toroid	T37-2 toroid core	3	red	
☐	Inductor	coil	1.3uH: 17T #27(11in) on T30-2(red)	1	red	
☐	Inductor	coil	2.7uH: 25T #27(15in) on T30-2(red)	1	red	
☐	Inductor	coil	4.6uH: 32T #27(18in) on T30-2(red)	3	red	
☐	Inductor	coil	10uH: 48T #27(26in)	2	red	

Resources

- Great supplies for making and canning jellies!

Who Can Help

- How to Lose 30+lbs Guaranteed. Try it Free.

			on T30-2(red)			
☐	Inductor	coil	20uH: 68T #30(36in) on T30-2(red)	2	red	
☐	Inductor	coil	26uH: 80T #30(43in) on T37-2(red)	1	red	
☐	Inductor	coil	55uH: 117T #30(61in) on T37-2(red)	2	red	
☐	Inductor	xfrmr	70.56uH: 7T(bi)T #30(16 (2x8)in) on BN43-2402	1		
☐	Inductor	xfrmr	70.56uH: 7T/3T(bi)T #30(18 (8/2x5)in) on BN43-2402	1		
☐	Resistor	1/4W	10 ohm 1/4W 1%	2	br-blk-blk-gld-br	
☐	Resistor	1/6W	2.2k 1/6W 5%	6	red-red-red-gld	
☐	wire	Cutoff	shunt wire (cut-off lead)	5		
☐	wire	Magnetic	Magnetic Wire, enameled #30	4		

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Detailed Build Steps

Install BPF In/Out Components

Inductor Information

in oral form, is the major treatment for Parkinson's disease. Levodopa is the natural

The main objective of this GCP compliant pilot study was to assess the pharmacokinetic profile of levodopa in the blood of healthy volunteers following application of ND0601.

"I am excited to have started the clinical development of ND0601, a transdermal levodopa patch offering great hope for improving the disabling problems common in advanced Parkinson's disease patients. ND0601 should provide continuous delivery of levodopa in a widely accessible form, a highly sought after treatment option in Parkinson's disease that has been unavailable to date" said Oded S. Lieberman, PhD, NeuroDerm's Chairman. "We believe that, by maintaining a steady levodopa blood concentration, ND0601 should minimize or even abolish dyskinesias and other disabling motor complications associated with long-term oral levodopa administration in advanced Parkinson's disease. This novel patch may also help to avoid the development of such complications if used as an initial treatment for Parkinson's disease" said Eli Heldman, PhD, and Moshe Kushnir, MD, the company's founders.

Parkinson's disease patients often suffer from dyskinesias (involuntary, disruptive, jerky movements associated with long-term levodopa therapy) and "off" time (periods of immobility) that result from the fluctuations in levodopa blood concentrations inherent with oral administration of levodopa. ND0601 is based on a proprietary formulation containing levodopa ester as a prodrug that enables the continuous delivery of levodopa through the skin, thereby overcoming the limitations of its short half life. The company previously demonstrated success at maintaining steady therapeutic levodopa blood levels in preclinical animal testing.

This trial was funded by The Michael J. Fox Foundation for Parkinson's Research through its highly competitive 2006 Clinical Discovery Program.

About NeuroDerm Ltd.

NeuroDerm is a clinical stage pharmaceutical company, specializing in transdermal therapies for CNS diseases. NeuroDerm was founded on the basis of research started more than ten years ago to solve the problem of continuous delivery of levodopa in Parkinson's disease. The company's core technology and various formulations are protected by strong, wide scope applications and issued patents

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800.327.4545

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Common Techniques:

- **Wire Gauge:** remember the higher the number, the thinner the wire. E.g., #30 wire is thinner than #26 wire.
- One turn:
    - For toroids, one turn is a single pass through the center hole.
    - For binocular cores, one turn is a pass in which the wire goes in the bottom, comes out the top, goes back in the other hole at the top, and comes out the other hole at the bottom.
- Bi (tri) filar means 2(3) equal lengths of wire. You get the bi(tri)filar strand by taking the length of wire specified for the primary winding, folding it into half(thirds), twisting it to 3~ twists per inch, and winding it over the primary winding. One end of such a strand will have two(three) leads; the other end will have a "hairpin" bend (and a single lead in the case of tri-filar).
- Multi-filar windings are usually done AFTER the uni-filar winding is done.
- Windings shoud be evenly spaced and ideally made such that the winding covers ~345 degrees of the toroid
- Inductance values given are for the single (uni-filar) winding. They are provided to help verify turn counts and core material selected.
- Toroid nomenclature provides the outside diameter of the toroid (in hundredths of an inch - the "30" in "T30-2"), and material code (the "2" in "T30-2"). Color codes used in these kits are:
    - 2=Red
    - 3=Gray
    - 6=Yellow
    - 7=White
    - 10=Black
    - 12=Green (with White on opposite side)

Inductors In This Step

T02

XFRMR: 70.56uH: 7T(bi)T #30(16 (2x8)in) on BN43-2402
Using a total of approximately 15 inches of #30 wire, wind 7 turns , bifilar, on a BN-43-2402 ferrite.Inductance of the single winding (usually the primary) is 70.56 uH.

T03

XFRMR: 70.56uH: 7T/3T(bi)T #30(18 (8/2x5)in) on BN43-2402
Primary: Using approximately 9 inches of #30 wire, wind 7 turns on a BN-43-2402 ferrite.
Secondary: Using a total of 9 inches of #30 wire, wind 3 turns , bifilar, on the ferrite in the same direction as the primary winding. Inductance of the single winding (usually the primary) is 70.56 uH.

2009 Tax Computation Worksheet

Caution Use the Tax Computation Worksheet to figure your tax if your taxable income is $100,000 or more.

Section A – Use if your filing status is **Single** or **Head of household**. Complete the row below that applies to you.

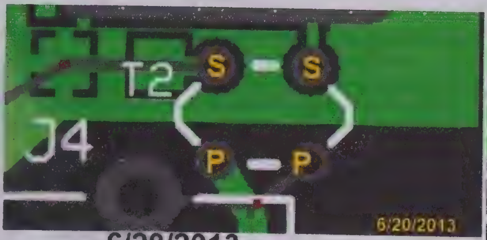
Taxable income. If line 5 is –	(a) Fill in the amount from line 5	(b) Multiplication amount	(c) Multiply (a) by (b)	(d) Subtraction amount	(e) Subtract (d) from (c). Fill in the result here and on Form 1X, line 6
At least $100,000 but less than $153,280	$	x 6.5% (.065)	$	$ 229.95	$
At least $153,280 but less than $225,000	$	x 6.75% (.0675)	$	$ 613.15	$
$225,000 or over	$	x 7.75% (.0775)	$	$2,863.15	$

Section B – Use if your filing status is **Married filing jointly**. Complete the row below that applies to you.

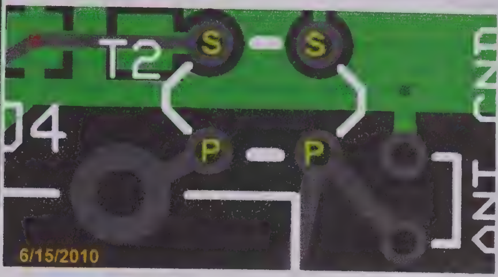
Taxable income. If line 5 is –	(a) Fill in the amount from line 5	(b) Multiplication amount	(c) Multiply (a) by (b)	(d) Subtraction amount	(e) Subtract (d) from (c). Fill in the result here and on Form 1X, line 6
At least $100,000 but less than $204,370	$	x 6.5% (.065)	$	$ 306.48	$
At least $204,370 but less than $300,000	$	x 6.75% (.0675)	$	$ 817.41	$
$300,000 or over	$	x 7.75% (.0775)	$	$3,817.41	$

Section C – Use if your filing status is **Married filing separately**. Complete the row below.

Taxable income. If line 5 is –	(a) Fill in the amount from line 5	(b) Multiplication amount	(c) Multiply (a) by (b)	(d) Subtraction amount	(e) Subtract (d) from (c). Fill in the result here and on Form 1X, line 6
At least $100,000 but less than $102,190	$	x 6.5% (.065)	$	$ 153.22	$
At least $102,190 but less than $150,000	$	x 6.75% (.0675)	$	$ 408.70	$
$150,000 or over	$	x 7.75% (.0775)	$	$1,908.70	$

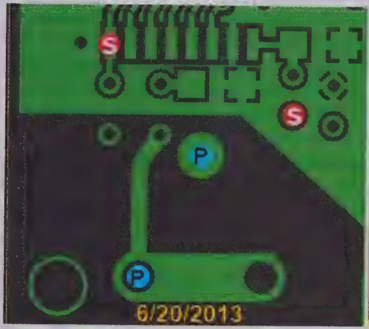


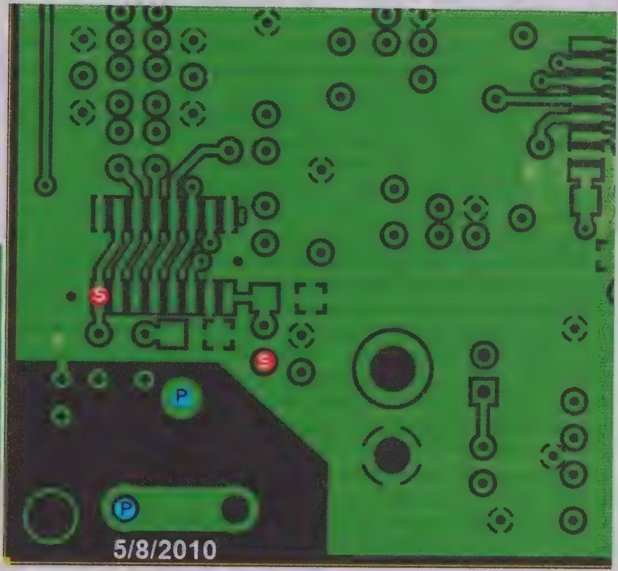
6/20/2013
Board Mod



Includes winding and installing the two binocular transformers, T2 and T3.

6/20/2013
Board Mod





T2 has a single primary and a single secondary windings; T3 one primary and two secondary windings.

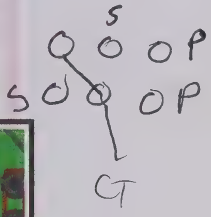
> ALERT! Original Ensemble RXII PCB layouts have an error in the placement of the leads for T2, the Antenna isolation transformer. If the antenna isolation transformer is not connected properly then the outer of the antenna coax will be prone to common mode currents causing noise pickup on receive. The principle is that the grounded side of the isolation transformers should go to the same end of the primary and secondary. The two wires that come from the same hole in the binocular core.:must be switched (for one of the windings, primary orsecondary - your choice). See the article by Alan G4ZFQ for IMPORTANT details.
>
> There has been a revision of the PCB (look for the 6/20/2013 date on the board) which makes this switching of the leads unnecessary.

If line 5 (Taxable income) is —		And you are —			If line 5 (Taxable income) is —		And you are —			If line 5 (Taxable income) is —		And you are —		
At least	But less than	Single or Head of a household	Married filing jointly	Married filing separately	At least	But less than	Single or Head of a household	Married filing jointly	Married filing separately	At least	But less than	Single or Head of a household	Married filing jointly	Married filing separately
		Your tax is —					Your tax is —					Your tax is —		
65,000					**71,000**					**77,000**				
65,000	**65,100**	3,998	3,922	4,075	**71,000**	**71,100**	4,388	4,312	4,465	**77,000**	**77,100**	4,778	4,702	4,855
65,100	**65,200**	4,005	3,928	4,082	**71,100**	**71,200**	4,395	4,318	4,472	**77,100**	**77,200**	4,785	4,708	4,862
65,200	**65,300**	4,011	3,935	4,088	**71,200**	**71,300**	4,401	4,325	4,478	**77,200**	**77,300**	4,791	4,715	4,868
65,300	**65,400**	4,018	3,941	4,095	**71,300**	**71,400**	4,408	4,331	4,485	**77,300**	**77,400**	4,798	4,721	4,875
65,400	**65,500**	4,024	3,948	4,101	**71,400**	**71,500**	4,414	4,338	4,491	**77,400**	**77,500**	4,804	4,728	4,881
65,500	**65,600**	4,031	3,954	4,108	**71,500**	**71,600**	4,421	4,344	4,498	**77,500**	**77,600**	4,811	4,734	4,888
65,600	**65,700**	4,037	3,961	4,114	**71,600**	**71,700**	4,427	4,351	4,504	**77,600**	**77,700**	4,817	4,741	4,894
65,700	**65,800**	4,044	3,967	4,121	**71,700**	**71,800**	4,434	4,357	4,511	**77,700**	**77,800**	4,824	4,747	4,901
65,800	**65,900**	4,050	3,974	4,127	**71,800**	**71,900**	4,440	4,364	4,517	**77,800**	**77,900**	4,830	4,754	4,907
65,900	**66,000**	4,057	3,980	4,134	**71,900**	**72,000**	4,447	4,370	4,524	**77,900**	**78,000**	4,837	4,760	4,914
66,000					**72,000**					**78,000**				
66,000	**66,100**	4,063	3,987	4,140	**72,000**	**72,100**	4,453	4,377	4,530	**78,000**	**78,100**	4,843	4,767	4,920
66,100	**66,200**	4,070	3,993	4,147	**72,100**	**72,200**	4,460	4,383	4,537	**78,100**	**78,200**	4,850	4,773	4,927
66,200	**66,300**	4,076	4,000	4,153	**72,200**	**72,300**	4,466	4,390	4,543	**78,200**	**78,300**	4,856	4,780	4,933
66,300	**66,400**	4,083	4,006	4,160	**72,300**	**72,400**	4,473	4,396	4,550	**78,300**	**78,400**	4,863	4,786	4,940
66,400	**66,500**	4,089	4,013	4,166	**72,400**	**72,500**	4,479	4,403	4,556	**78,400**	**78,500**	4,869	4,793	4,946
66,500	**66,600**	4,096	4,019	4,173	**72,500**	**72,600**	4,486	4,409	4,563	**78,500**	**78,600**	4,876	4,799	4,953
66,600	**66,700**	4,102	4,026	4,179	**72,600**	**72,700**	4,492	4,416	4,569	**78,600**	**78,700**	4,882	4,806	4,959
66,700	**66,800**	4,109	4,032	4,186	**72,700**	**72,800**	4,499	4,422	4,576	**78,700**	**78,800**	4,889	4,812	4,966
66,800	**66,900**	4,115	4,039	4,192	**72,800**	**72,900**	4,505	4,429	4,582	**78,800**	**78,900**	4,895	4,819	4,972
66,900	**67,000**	4,122	4,045	4,199	**72,900**	**73,000**	4,512	4,435	4,589	**78,900**	**79,000**	4,902	4,825	4,979
67,000					**73,000**					**79,000**				
67,000	**67,100**	4,128	4,052	4,205	**73,000**	**73,100**	4,518	4,442	4,595	**79,000**	**79,100**	4,908	4,832	4,985
67,100	**67,200**	4,135	4,058	4,212	**73,100**	**73,200**	4,525	4,448	4,602	**79,100**	**79,200**	4,915	4,838	4,992
67,200	**67,300**	4,141	4,065	4,218	**73,200**	**73,300**	4,531	4,455	4,608	**79,200**	**79,300**	4,921	4,845	4,998
67,300	**67,400**	4,148	4,071	4,225	**73,300**	**73,400**	4,538	4,461	4,615	**79,300**	**79,400**	4,928	4,851	5,005
67,400	**67,500**	4,154	4,078	4,231	**73,400**	**73,500**	4,544	4,468	4,621	**79,400**	**79,500**	4,934	4,858	5,011
67,500	**67,600**	4,161	4,084	4,238	**73,500**	**73,600**	4,551	4,474	4,628	**79,500**	**79,600**	4,941	4,864	5,018
67,600	**67,700**	4,167	4,091	4,244	**73,600**	**73,700**	4,557	4,481	4,634	**79,600**	**79,700**	4,947	4,871	5,024
67,700	**67,800**	4,174	4,097	4,251	**73,700**	**73,800**	4,564	4,487	4,641	**79,700**	**79,800**	4,954	4,877	5,031
67,800	**67,900**	4,180	4,104	4,257	**73,800**	**73,900**	4,570	4,494	4,647	**79,800**	**79,900**	4,960	4,884	5,037
67,900	**68,000**	4,187	4,110	4,264	**73,900**	**74,000**	4,577	4,500	4,654	**79,900**	**80,000**	4,967	4,890	5,044
68,000					**74,000**					**80,000**				
68,000	**68,100**	4,193	4,117	4,270	**74,000**	**74,100**	4,583	4,507	4,660	**80,000**	**80,100**	4,973	4,897	5,050
68,100	**68,200**	4,200	4,123	4,277	**74,100**	**74,200**	4,590	4,513	4,667	**80,100**	**80,200**	4,980	4,903	5,057
68,200	**68,300**	4,206	4,130	4,283	**74,200**	**74,300**	4,596	4,520	4,673	**80,200**	**80,300**	4,986	4,910	5,063
68,300	**68,400**	4,213	4,136	4,290	**74,300**	**74,400**	4,603	4,526	4,680	**80,300**	**80,400**	4,993	4,916	5,070
68,400	**68,500**	4,219	4,143	4,296	**74,400**	**74,500**	4,609	4,533	4,686	**80,400**	**80,500**	4,999	4,923	5,076
68,500	**68,600**	4,226	4,149	4,303	**74,500**	**74,600**	4,616	4,539	4,693	**80,500**	**80,600**	5,006	4,929	5,083
68,600	**68,700**	4,232	4,156	4,309	**74,600**	**74,700**	4,622	4,546	4,699	**80,600**	**80,700**	5,012	4,936	5,089
68,700	**68,800**	4,239	4,162	4,316	**74,700**	**74,800**	4,629	4,552	4,706	**80,700**	**80,800**	5,019	4,942	5,096
68,800	**68,900**	4,245	4,169	4,322	**74,800**	**74,900**	4,635	4,559	4,712	**80,800**	**80,900**	5,025	4,949	5,102
68,900	**69,000**	4,252	4,175	4,329	**74,900**	**75,000**	4,642	4,565	4,719	**80,900**	**81,000**	5,032	4,955	5,109
69,000					**75,000**					**81,000**				
69,000	**69,100**	4,258	4,182	4,335	**75,000**	**75,100**	4,648	4,572	4,725	**81,000**	**81,100**	5,038	4,962	5,115
69,100	**69,200**	4,265	4,188	4,342	**75,100**	**75,200**	4,655	4,578	4,732	**81,100**	**81,200**	5,045	4,968	5,122
69,200	**69,300**	4,271	4,195	4,348	**75,200**	**75,300**	4,661	4,585	4,738	**81,200**	**81,300**	5,051	4,975	5,128
69,300	**69,400**	4,278	4,201	4,355	**75,300**	**75,400**	4,668	4,591	4,745	**81,300**	**81,400**	5,058	4,981	5,135
69,400	**69,500**	4,284	4,208	4,361	**75,400**	**75,500**	4,674	4,598	4,751	**81,400**	**81,500**	5,064	4,988	5,141
69,500	**69,600**	4,291	4,214	4,368	**75,500**	**75,600**	4,681	4,604	4,758	**81,500**	**81,600**	5,071	4,994	5,148
69,600	**69,700**	4,297	4,221	4,374	**75,600**	**75,700**	4,687	4,611	4,764	**81,600**	**81,700**	5,077	5,001	5,154
69,700	**69,800**	4,304	4,227	4,381	**75,700**	**75,800**	4,694	4,617	4,771	**81,700**	**81,800**	5,084	5,007	5,161
69,800	**69,900**	4,310	4,234	4,387	**75,800**	**75,900**	4,700	4,624	4,777	**81,800**	**81,900**	5,090	5,014	5,167
69,900	**70,000**	4,317	4,240	4,394	**75,900**	**76,000**	4,707	4,630	4,784	**81,900**	**82,000**	5,097	5,020	5,174
70,000					**76,000**					**82,000**				
70,000	**70,100**	4,323	4,247	4,400	**76,000**	**76,100**	4,713	4,637	4,790	**82,000**	**82,100**	5,103	5,027	5,180
70,100	**70,200**	4,330	4,253	4,407	**76,100**	**76,200**	4,720	4,643	4,797	**82,100**	**82,200**	5,110	5,033	5,187
70,200	**70,300**	4,336	4,260	4,413	**76,200**	**76,300**	4,726	4,650	4,803	**82,200**	**82,300**	5,116	5,040	5,193
70,300	**70,400**	4,343	4,266	4,420	**76,300**	**76,400**	4,733	4,656	4,810	**82,300**	**82,400**	5,123	5,046	5,200
70,400	**70,500**	4,349	4,273	4,426	**76,400**	**76,500**	4,739	4,663	4,816	**82,400**	**82,500**	5,129	5,053	5,206
70,500	**70,600**	4,356	4,279	4,433	**76,500**	**76,600**	4,746	4,669	4,823	**82,500**	**82,600**	5,136	5,059	5,213
70,600	**70,700**	4,362	4,286	4,439	**76,600**	**76,700**	4,752	4,676	4,829	**82,600**	**82,700**	5,142	5,066	5,219
70,700	**70,800**	4,369	4,292	4,446	**76,700**	**76,800**	4,759	4,682	4,836	**82,700**	**82,800**	5,149	5,072	5,226
70,800	**70,900**	4,375	4,299	4,452	**76,800**	**76,900**	4,765	4,689	4,842	**82,800**	**82,900**	5,155	5,079	5,232
70,900	**71,000**	4,382	4,305	4,459	**76,900**	**77,000**	4,772	4,695	4,849	**82,900**	**83,000**	5,162	5,085	5,239

So check your board version to see which approach to mounting the transformer applies.

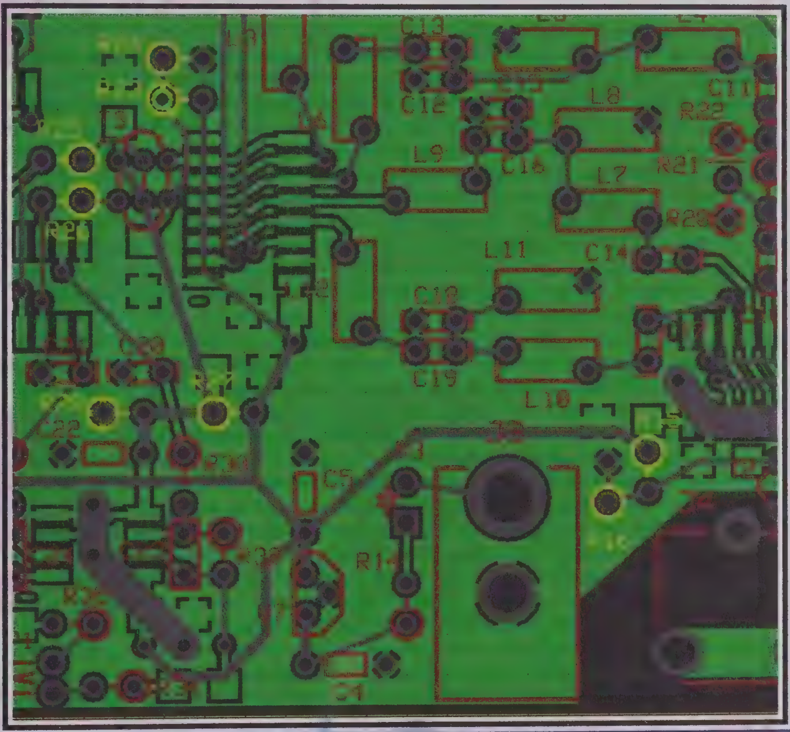
The T3 secondary windings are connected by a trace on the board such that the secondary winding ends not connected together are 180 degrees phase different. Only one secondary winding is connected through the QSD switches of U10 at any instant of time resulting in signal integration on capacitors C20 and C21. T3 also provides a 4:1 Z transformation from the BPF to the QSD circuit.

Top of T3



Once the transformers are wound and installed, you should turn the board over and run continuity tests on the primary and secondary windings, per the above diagram.

Finally, install the BPF In/Out Resistors to complete this step.



Check	Designation	Component (top/bottom)	Orientation	Marking	Image	Band	Notes
☑	R23	2.2k 1/6W 5% (top)	W-E	red-red-red-gld	▮▮▮	any	
☑	T02	70.56uH: 7T(bi)T #30(16 (2x8)in) on BN43-2402				LF	

Alice Linn: I Want to Be Your Polka Sweetheart

Norman Field, Richard Simmons, Terry Knight
The Red Light Trio

Klaus Ogerman
Music of the 1920s

Frank Sinatra with Harry James & His Orchestra
All Or Nothing At All

Gene Krupa
Gene Krupa's Chicago Jazz Band (1958)

Jackie & Roy
(*Jackie & Roy: Jazz Classics* by Johnny Ventura's Band)

Blue Diamonds (1961)

Jackie Cain & Roy Kral
Bits and Pieces (1957)

John Sidney
Sing Along with John Sidney

West Ham United Cup Squad

Cockney Rejects
Punk Singles Collection

Mitch Miller
More Memories by Mitch

Charles Hart (1920)

Paul Thomas

Charlie Spivak

Doris Day & Jack Smith
Secret Love

Cliff Adams Singers
(*Sing Something Simple*)

Westy Westenhofer
Bubbles (2004)

Kirby Stone Four
"Go" Sound/The Kirby Stone Touch (1959)

Dick Barrett
Dick Barrett Waltz Album

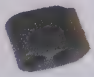
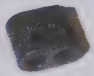
Guy Lombardo

Chet Atkins

Max Bygraves

The Dick Hyman Group with Howard Alden as Emmet Ray
Sweet & Lowdown (2000)

Corliss Lamont *Sings for His Family and Friends, a Medley of Favorite Hit Songs from American Musicals* (1977)

		(top)					
☐	T02-core	BN-43-2402 (no markings!) (top)		none		any	
☑	T03	70.56uH: 7T/3T(bi)T #30(18 (8/2x5)in) on BN43-2402 (top)				LF	
☐	T03-core	BN-43-2402 (no markings!) (top)		none		any	
☑	R15	2.2k 1/6W 5% (top)	N-S	red-red-red-gld		any	
☑	R16	2.2k 1/6W 5% (top)	N-S	red-red-red-gld		any	
☑	R24	2.2k 1/6W 5% (top)	W-E	red-red-red-gld		any	
☑	R25	10 ohm 1/4W 1% (top)	E-W	br-blk-blk-gld-br		any	
☑	R26	10 ohm 1/4W 1% (top)	E-W	br-blk-blk-gld-br		any	
☑	R27	2.2k 1/6W 5% (top)		red-red-red-gld		any	
☑	R28	2.2k 1/6W 5% (top)		red-red-red-gld		any	

Install and Continuity Test the Band 0 BPF

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More Polar Bears Going Hungry

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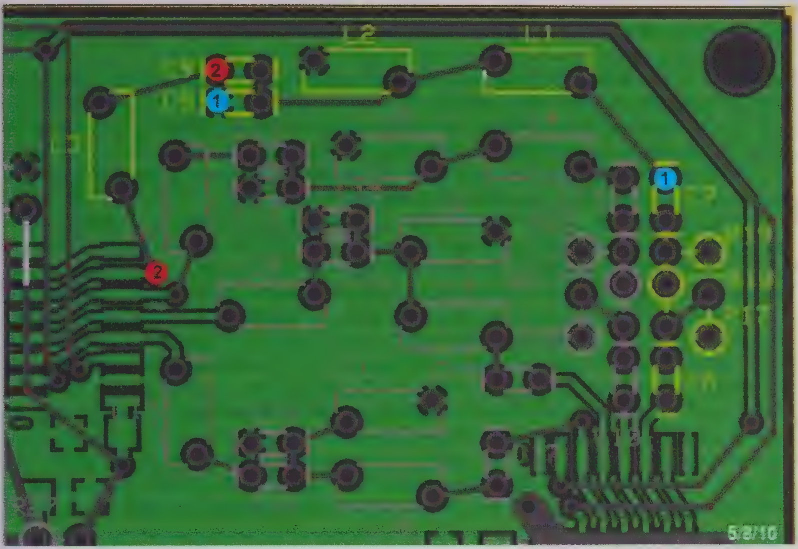

In this step and the two steps following it, you will build the bandpass filter for the band 0 passband.

Check	Designation	Component (top/bottom)	Orientation	Marking	Image	Band	Notes
☐	magwire_165in	Magnetic Wire, enameled #30 (top)				any	

Install the Band 0 Inductors

Inductor Information

Common Techniques:

- **Wire Gauge:** remember the higher the number, the thinner the wire. E.g., #30 wire is thinner than #26 wire.
- One turn:
    - For toroids, one turn is a single pass through the center hole.
    - For binocular cores, one turn is a pass in which the wire goes in the bottom, comes out the top, goes back in the other hole at the top, and comes out the other hole at the bottom.
- Bi (tri) filar means 2(3) equal lengths of wire. You get the bi(tri)filar strand by taking

the length of wire specified for the primary winding, folding it into half(thirds), twisting it to 3~ twists per inch, and winding it over the primary winding. One end of such a strand will have two(three) leads; the other end will have a "hairpin" bend (and a single lead in the case of tri-filar).

- Multi-filar windings are usually done AFTER the uni-filar winding is done.
- Windings shoud be evenly spaced and ideally made such that the winding covers ~345 degrees of the toroid
- Inductance values given are for the single (uni-filar) winding. They are provided to help verify turn counts and core material selected.
- Toroid nomenclature provides the outside diameter of the toroid (in hundredths of an inch - the "30" in "T30-2"), and material code (the "2" in "T30-2"). Color codes used in these kits are:
  - 2=Red
  - 3=Gray
  - 6=Yellow
  - 7=White
  - 10=Black
  - 12=Green (with White on opposite side)

Inductors In This Step

L01

COIL: 55uH: 117T #30(61in) on T37-2(red)
Using approximately 61 inches of #30 wire, wind 117 turns on a 0.37 inch od T37-2(red) ferrite. Inductance = 55.00 uH.

L02

COIL: 26uH: 80T #30(43in) on T37-2(red)
Using approximately 43 inches of #30 wire, wind 80 turns on a 0.37 inch od T37-2(red) ferrite. Inductance = 26.00 uH.

L03

COIL: 55uH: 117T #30(61in) on T37-2(red)
Using approximately 61 inches of #30 wire, wind 117 turns on a 0.37 inch od T37-2(red) ferrite. Inductance = 55.00 uH.

First, you want to wind and install the coils and then continuity test them. The continuity test checks for continuity between the points labeled "1" and then tests the continuity between the points labeled "2". Wherever possible, the test points have been assigned to vias removed from but electrically connected to the coils' vias, so as to give a good test of the soldering.

Check	Designation	Component (top/bottom)	Orientation	Marking	Image	Band	Notes
☐	L01	55uH: 117T #30(61in) on T37-2(red) (top)		red		LF	

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- WATCH: Giant Shark Washes Ashore on Long Island
- PHOTOS: Sandra Bullock Does First Nude Scene--After 40!
- PHOTOS: Owen and Woody's Bromantic Getaway In Italy
- PHOTOS: Kate Gosselin's Muscular Arms

More Popular News »

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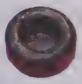
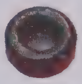
323		Is This One of The 7 Wonders of Nature?
302		Amtrak Unveils First Rail Car Funded by Stimulus

GOOD MORNING AMERICA 2009 SUMMER CONCERT SERIES PRESENTED BY Walgreens [CLICK HERE]

ABC News Features

☐	L01-core	T37-2 toroid core (top)		red		LF	0.37" (9.4mm) outside diameter core
☐	L02	26uH: 80T #30(43in) on T37-2(red) (top)		red		LF	
☐	L02-core	T37-2 toroid core (top)		red		LF	0.37" (9.4mm) outside diameter core
☐	L03	55uH: 117T #30(61in) on T37-2(red) (top)		red		LF	
☐	L03-core	T37-2 toroid core (top)		red		LF	0.37" (9.4mm) outside diameter core

Install the Band 0 Static Components

Once you have successfully verified continuity, you can proceed to install the remaining parts for the passband.

Check	Designation	Component (top/bottom)	Orientation	Marking	Image	Band	Notes
☑	C06	shunt wire (cut-off lead) (top)	vert			LF	(jumper for LF)
☑	C07	6800 pF 5% (top)	vert	682		LF	
☑	C08	0.015 uF 5% (top)	horiz	153		LF	
☑	C09	6800 pF 5% (top)	horiz	682		LF	
☐	R17	omit for this band (top)	S-N			LF	
☑	R18	shunt wire (cut-off lead) (top)	N-S			LF	(jumper for LF)

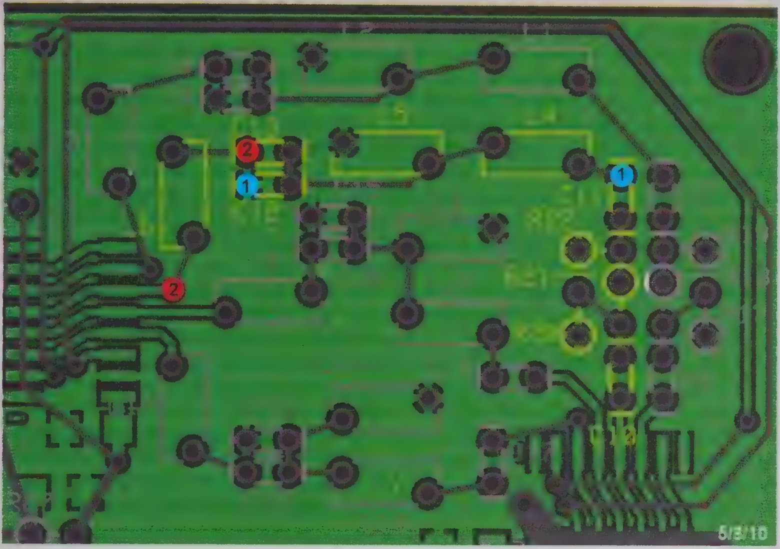
KPH", and was one of Frank's "pillars of strength" along with Ray Smith. When Jack became manager of the station he didn't know he would be the last in a distinguished line. But when it fell to him to finally close the station he left all the receivers on to keep a symbolic watch over the airwaves. That tells you a lot about the kind of man Jack is and how he felt about his job and KPH.

Jack kept a journal during his time at KPH. We are privileged to present it here. Read about what life was really like at KPH in its glory days.

to the MRHS main page...

☐	R19	omit for this band (top)	E-W			LF	

Install and Continuity Test the Band 1 BPF



In this step and the two steps following it, you will build the bandpass filter for the band 1 passband.

First, you want to wind and install the coils and then continuity test them. The continuity test checks for continuity between the points labeled "1" and then tests the continuity between the points labeled "2". Wherever possible, the test points have been assigned to vias removed from but electrically connected to the coils' vias, so as to give a good test of the soldering.

Once you have successfully verified continuity, you can proceed to install the remaining parts for the passband.

Check	Designation	Component (top/bottom)	Orientation	Marking	Image	Band	Notes
☐	magwire_90in	Magnetic Wire, enameled #30 (top)				any	

Reyes National Seashore to preserve and restore KPH with the goal of eventually creating a museum dedicated to this great station that was once heard throughout the world.

On 12 July 2000 KPH returned to the air from its original location, using its original equipment and its original frequencies - generously made available by Globe Wireless, the current owner of the KPH license and operator of the equally famous KFS from which the last commercial Morse message was sent.

Veteran operators, radio engineers and those with an interest in radio history gathered at

Install the Band 1 Inductors

Grandma's Boys
When the Toy Soldiers Marched on Parade
(1980s)

Charlie Ventura
I'm Forever Blowing Bubbles

Joan Morris
(*Moonlight Bay*, 1999)

Ella Logan

Fred Lowry

George Gershwin
Gershwin Plays Gershwin

Frank Fontaine
("Crazy Guggenheim" on the Jackie Gleason show)

Charlie Parker
The Charlie Parker Story

To Site Map

last updated: 04/22/2009

Palm Court Theatre Orchestra
(*The Picnic Party*)

Green Street Holligans

Les Paul and Mary Ford

Howard Alden and Bucky Pizzarelli
In a Mellow Tone

Inductor Information

Common Techniques:

- **Wire Gauge:** remember the higher the number, the thinner the wire. E.g., #30 wire is thinner than #26 wire.
- One turn:
  - For toroids, one turn is a single pass through the center hole.
  - For binocular cores, one turn is a pass in which the wire goes in the bottom, comes out the top, goes back in the other hole at the top, and comes out the other hole at the bottom.
- Bi (tri) filar means 2(3) equal lengths of wire. You get the bi(tri)filar strand by taking the length of wire specified for the primary winding, folding it into half(thirds), twisting it to 3~ twists per inch, and winding it over the primary winding. One end of such a strand will have two(three) leads; the other end will have a "hairpin" bend (and a single lead in the case of tri-filar).
- Multi-filar windings are usually done AFTER the uni-filar winding is done.
- Windings shoud be evenly spaced and ideally made such that the winding covers ~345 degrees of the toroid
- Inductance values given are for the single (uni-filar) winding. They are provided to help verify turn counts and core material selected.
- Toroid nomenclature provides the outside diameter of the toroid (in hundredths of an inch - the "30" in "T30-2"), and material code (the "2" in "T30-2"). Color codes used in these kits are:
  - 2=Red
  - 3=Gray
  - 6=Yellow
  - 7=White
  - 10=Black
  - 12=Green (with White on opposite side)

Inductors In This Step

L04

COIL: 20uH: 68T #30(36in) on T30-2(red)
Using approximately 36 inches of #30 wire, wind 68 turns on a 0.30 inch od T30-2(red) ferrite. Inductance = 20.00 uH.

L05

COIL: 4.6uH: 32T #27(18in) on T30-2(red)
Using approximately 19 inches of 27 wire, wind 32 turns on a 0.30 inch od T30-2(red) ferrite. Inductance = 4.60 uH.

L06

COIL: 20uH: 68T #30(36in) on T30-2(red)
Using approximately 36 inches of #30 wire, wind 68 turns on a 0.30 inch od T30-2(red) ferrite. Inductance = 20.00 uH.

First, you want to wind and install the coils and then continuity test them. The continuity

This is Google's cache of http://bubbleblowers.com/music/Music.html. It is a snapshot of the page as it appeared on Jul 22, 2009 16:53:27 GMT. The current page could have changed in the meantime. Learn more

These search terms are highlighted: **i m forever blowing bubbles** Text-only version

I'M FOREVER BLOWING BUBBLES

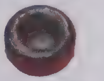
(Jaan Kenbrovin* and John William Kellette)

CHORUS:

Listen to the linked versions of the song:

Helen Clark and George Wilton Ballard (1920)

from a 1919 Blue Amberol cylinder recording manufactured by the Edison company test checks for continuity between the points labeled "1" and then tests the continuity between the points labeled "2". Wherever possible, the test points have been assigned to vias removed from but electrically connected to the coils' vias, so as to give a good test of the soldering.

Check	Designation	Component (top/bottom)	Orientation	Marking	Image	Band	Notes
☐	L04-core	T30-2 toroid core (top)		red		any	0.30" (7.62mm) outside diameter core
☐	L05	4.6uH: 32T #27(18in) on T30-2(red) (top)		red	4.6uH: 32T #27(18in) on T30-2(red)	LF	was #30
☐	L05-core	T30-2 toroid core (top)		red		any	0.30" (7.62mm) outside diameter core
☐	L04	20uH: 68T #30(36in) on T30-2(red) (top)		red		LF	
☐	L06	20uH: 68T #30(36in) on T30-2(red) (top)		red		LF	
☐	L06-core	T30-2 toroid core (top)		red		any	0.30" (7.62mm) outside diameter core

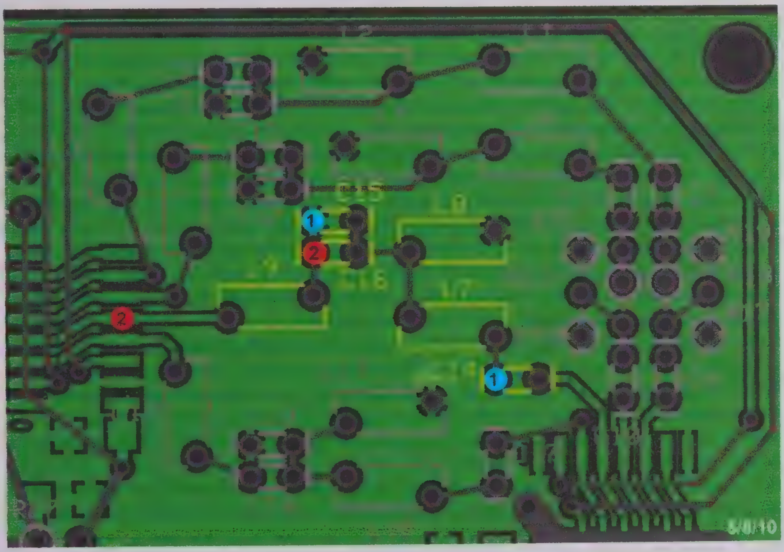
Install the Band 1 Static Components

Once you have successfully verified continuity, you can proceed to install the remaining parts for the passband.

Check	Designation	Component (top/bottom)	Orientation	Marking	Image	Band	Note
☑	C10	shunt wire (cut-off lead) (top)	vert			LF	(jum for L

☑	C11	3300 pF 5% (top)	vert	332		LF	
☑	C12	0.015 uF 5% (top)	horiz	153		LF	
☑	C13	3300 pF 5% (top)	horiz	332		LF	
☐	R20	omit for this band (top)	S-N			LF	
☑	R21	shunt wire (cut-off lead) (top)	N-S			LF	(jum for L
☐	R22	omit for this band (top)	W-E			LF	

Install and Continuity Test the Band 2 BPF



In this step and the two steps following it, you will build the bandpass filter for the band 2 passband.

First, you want to wind and install the coils and then continuity test them. The continuity test checks for continuity between the points labeled "1" and then tests the continuity between the points labeled "2". Wherever possible, the test points have been assigned to vias removed from but electrically connected to the coils' vias, so as to give a good test of

awake, My bluebird flutters away. "Happiness, you seem so near me,	Henry Burr & Albert Campbell (1919)

the soldering.

Once you have successfully verified continuity, you can proceed to install the remaining parts for the passband.

Check	Designation	Component (top/bottom)	Orientation	Marking	Image	Band	Notes
☐	magwire_67in	Magnetic Wire, enameled #30 (top)				any	

Install the Band 2 Inductors

Inductor Information

Common Techniques:

- **Wire Gauge:** remember the higher the number, the thinner the wire. E.g., #30 wire is thinner than #26 wire.
- One turn:
  - For toroids, one turn is a single pass through the center hole.
  - For binocular cores, one turn is a pass in which the wire goes in the bottom, comes out the top, goes back in the other hole at the top, and comes out the other hole at the bottom.
- Bi (tri) filar means 2(3) equal lengths of wire. You get the bi(tri)filar strand by taking the length of wire specified for the primary winding, folding it into half(thirds), twisting it to 3~ twists per inch, and winding it over the primary winding. One end of such a strand will have two(three) leads; the other end will have a "hairpin" bend (and a single lead in the case of tri-filar).
- Multi-filar windings are usually done AFTER the uni-filar winding is done.
- Windings shoud be evenly spaced and ideally made such that the winding covers ~345 degrees of the toroid
- Inductance values given are for the single (uni-filar) winding. They are provided to help verify turn counts and core material selected.
- Toroid nomenclature provides the outside diameter of the toroid (in hundredths of an inch - the "30" in "T30-2"), and material code (the "2" in "T30-2"). Color codes used in these kits are:
  - 2=Red
  - 3=Gray
  - 6=Yellow
  - 7=White
  - 10=Black
  - 12=Green (with White on opposite side)

the later product reviews, due to changements and improvements of measurements equipment, measurements filters, etcetera.

Green = excellent
Light green = good
Yellow = average
Orange = moderate
Red = poor

v 1.SEP.2011
Please send me an e-mail (to: hans at pa1hr dot nl) if you have corrections, remarks, etc.

L07

COIL: 10uH: 48T #27(26in) on T30-2(red)
Using approximately 27 inches of #27 wire, wind 48 turns on a 0.30 inch od T30-2(red) ferrite. Inductance = 10.00 uH.

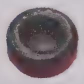
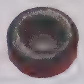
L08

COIL: 2.7uH: 25T #27(15in) on T30-2(red)
Using approximately 16 inches of #27 wire, wind 25 turns on a 0.30 inch od T30-2(red) ferrite. Inductance = 2.70 uH.

L09

COIL: 10uH: 48T #27(26in) on T30-2(red)
Using approximately 27 inches of #27 wire, wind 48 turns on a 0.30 inch od T30-2(red) ferrite. Inductance = 10.00 uH.

First, you want to wind and install the coils and then continuity test them. The continuity test checks for continuity between the points labeled "1" and then tests the continuity between the points labeled "2". Wherever possible, the test points have been assigned to vias removed from but electrically connected to the coils' vias, so as to give a good test of the soldering.

Check	Designation	Component (top/bottom)	Orientation	Marking	Image	Band	Notes
☐	L07	10uH: 48T #27(26in) on T30-2(red) (top)		red	10uH: 48T #27(26in) on T30-2(red)	LF	was #30
☐	L07-core	T30-2 toroid core (top)		red		LF	0.30" (7.62mm) outside diameter core
☐	L08	2.7uH: 25T #27(15in) on T30-2(red) (top)		red	2.7uH: 25T #27(15in) on T30-2(red)	LF	was #30
☐	L08-core	T30-2 toroid core (top)		red		LF	0.30" (7.62mm) outside diameter core
☐	L09	10uH: 48T #27(26in) on T30-2(red) (top)		red	10uH: 48T #27(26in) on	LF	was #30

James B & Elaine R Beyer 395-26-3300

Smart Worksheet for: Schedule B: Interest & Dividend Income

Interest Income Smart Worksheet

Payer's Name To access a Form 1099-INT, **QuickZoom** from a payer's name	Type	State ID	Box 1 or 3 Amount
Universty of Wisconsin Credit Union			256.00
Treasury Direct poBox 20 Phila. PA	U		7,328.00

Smart Worksheet for: Schedule B: Interest & Dividend Income

Dividend Income Smart Worksheet

Payer's Name To access 1099-DIV, **QuickZoom** from payer	Box 1 Ordinary Dividends	Box 2a Capital Gain Distributions	Box 2b Capital Gain At 28%	Box 3 Nontaxable Distributions	Box 5 Investment Expenses
Dreyfus 100% US Treas. Mny Mkt Fund	285.00				
Madison Gas and Electric Co.	666.00				
Allete (Minnesota Power and Light)	1,532.00				
See Additional Dividend Income	1,555.00	5,591.00			

Smart Worksheet for: Schedule B: Interest & Dividend Income

Exempt-Interest Dividends Smart Worksheet

Payer's Name	Total Dividends	*State ID	Private Activity Bond Amt included in Dividend
Vanguard Int Tax Exempt	5,739.00	XX	199.00
Dreyfus Sht Int Muni Bd Fund	4,229.00	XX	322.00
American Muni Term Trust	624.00	XX	6.00

Keep for your records

					T30-2(red)		
☐	L09-core	T30-2 toroid core (top)		red		LF	0.30" (7.62mm) outside diameter core

Install the Band 2 Static Components

Once you have successfully verified continuity, you can proceed to install the remaining parts for the passband.

Check	Designation	Component (top/bottom)	Orientation	Marking	Image	Band	Notes
☑	C14	1800 pF 5% (top)	horiz	182		LF	
☑	C15	6800 pF 5% (top)	horiz	682		LF	
☑	C16	1800 pF 5% (top)	horiz	182		LF	

Install and Continuity Test the Band 3 BPF

1X AMENDED return Wisconsin income tax

200

Complete form using BLACK INK

DO NOT STAPLE

Your social security number	Spouse's social security number

IMPORTANT
You must enter your social security number(s)

For year Jan. 1-Dec. 31, 2009, or other tax

beginning ____________________, 2009

ending ____________________, 20

Your legal last name	Legal first name	M.I.
If a joint return, spouse's legal last name	Spouse's legal first name	M.I.

Current home address (number and street)	Apt. No.

City or post office	State	Zip code

If married filing separate, fill in spouse's social security number above and full name here

Last name	First name	M.I.

- USE THIS FORM TO AMEND 2009 ONL *(See instructions)*
- PART-YEAR RESIDENTS OR NONRESIDENT MAY NOT USE THIS FORM.

Special conditions ☐

Filing status (Note You cannot change from joint to separate returns after the due date.)

On original return ▶ ☐ Single ☐ Married filing joint ☐ Married filing separate ☐ Head of household

On this return ▶ ☐ Single ☐ Married filing joint ☐ Married filing separate ☐ Head of household ▶ Also, check here if married ☐

See page 5 before assembling return

Print numbers like this → 0123456789 **Not like this →** 0147

NO COMMAS; NO CENTS

1 Wisconsin income *(see instructions)* . . . 1 ____ .0

Form W-2 wages included in line 1 . . . ▶ ____ .00

2 Standard deduction. See table on page 8, **OR** ▼ . . . 2 ____ .0

If someone else can claim you (or your spouse) as a dependent, see page 2 and check here . . ▶ ☐

3 Subtract line 2 from line 1. If line 2 is larger than line 1, fill in 0 . . . 3 ____ .0

4 Exemptions (Caution: see instructions, page 2)

a Fill in exemptions from your federal return ____ x $700 . . 4a ____ .00

b Check if 65 or older ☐ You + ☐ Spouse = ____ x $250 . . 4b ____ .00

c Add lines 4a and 4b . . . 4c ____ .0

5 Subtract line 4c from line 3. If line 4c is larger than line 3, fill in 0 . . . 5 ____ .0

6 Tax (see table on page 10) . . . 6 ____ .0

7 Itemized deduction credit . . . 7 ____ .00

8 Armed forces member credit . . . 8 ____ .00

9 School property tax credit

a Rent paid in 2009–heat included ____ .00
Rent paid in 2009–heat not included ____ .00 } Find credit from table page 6 .. 9a ____ .00

b Property taxes paid on home in 2009 ____ .00 Find credit from table page 7 .. 9b ____ .00

10 Historic rehabilitation credits . . . 10 ____ .00

11 Working families tax credit . . . 11 ____ .00

12 Certain nonrefundable credits from Schedule CR, line 3 . . . 12 ____ .00

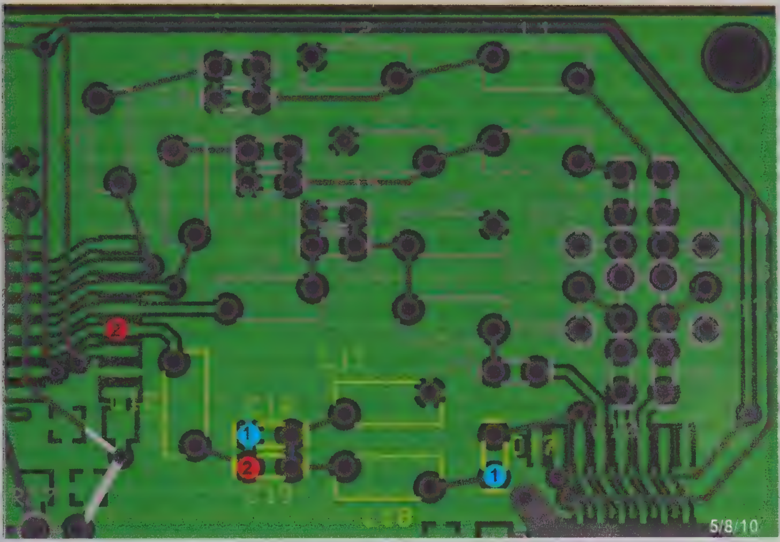
13 Add credits on lines 7 through 12 . . . 13 ____ .0

14 Subtract line 13 from line 6. If line 13 is more than line 6, fill in 0 . . . 14 ____ .0

15 Alternative minimum tax . . . 15 ____ .0

16 Add lines 14 and 15 . . . 16 ____ .0

PAPER CLIP payment here



In this step and the two steps following it, you will build the bandpass filter for the band 3 passband.

First, you want to wind and install the coils and then continuity test them. The continuity test checks for continuity between the points labeled "1" and then tests the continuity between the points labeled "2". Wherever possible, the test points have been assigned to vias removed from but electrically connected to the coils' vias, so as to give a good test of the soldering.

[illegible]

Once you have successfully verified continuity, you can proceed to install the remaining parts for the passband.

Check	Designation	Component (top/bottom)	Orientation	Marking	Image	Band	Notes
☐	magwire_47in	Magnetic Wire, enameled #30 (top)				any	

Install the Band 3 Inductors

X 1

[illegible]

Inductor Information

Common Techniques:

[illegible]

INSTRUCTIONS FOR 2009 WISCONSIN FORM 1X

GENERAL INSTRUCTIONS

Purpose of Form Use 2009 Form 1X to correct your 2009 Wisconsin Form 1, Form 1A, or Form WI-Z. If you need to correct your tax return for any year prior to 2009, contact any Wisconsin Department of Revenue office for the proper form. Prior year forms are also available from our Internet web site at www.revenue.wi.gov.

Caution You cannot use Form 1X to correct Form 1NPR (return for nonresidents and part-year residents). Instead, you must file a revised Form 1NPR. See the Form 1NPR Special Instructions for information on how to amend Form 1NPR.

Information on Income, Deductions, Credits, Etc. If you have questions on taxable income, allowable deductions, credits, etc., the instructions for the return you are amending may help you. You may also need to refer to certain tables and worksheets in the tax form instructions. If you need additional information or assistance, contact any Department of Revenue office.

When to File File Form 1X only after you file your original return. Generally, a claim for refund must be filed within 4 years after the unextended due date of your original return (for example, April 15, 2014, for 2009 calendar year returns).

However, a claim for refund to recover all or part of any tax paid as a result of an office or field audit may be filed within 4 years after the date assessed. This applies only if you paid the tax and did not file a petition for redetermination (written appeal).

Where to File Mail your Form 1X to the Wisconsin Department of Revenue at:

PO Box 8991
Madison WI 53708-8991

You may be able to electronically file your Form 1X using Wisconsin e-file. This free e-file service is available from the department's web site at www.revenue.wi.gov. Your form can be submitted electronically after you complete it. You may also be able to e-file Form 1X through your software package.

Where to Obtain Information and Forms Information and forms are available through our Internet web site at: www.revenue.wi.gov. You may e-mail your questions to: income@revenue.wi.gov. You may also obtain information, additional forms, and help in preparing Form 1X at the following department offices:

Madison –
2135 Rimrock Road
PO Box 8949 (zip code 53708-8949)
telephone:
forms requests . . . . (608) 266-1961
income tax information . . (608) 266-2772
homestead credit . . . . . . (608) 266-8641 or (608) 266-2772
TTY equipment (relay) . . 711

Milwaukee – State Office Building
819 North 6th Street (zip code 53203-1682)
telephone . . . . (414) 227-4000
TTY equipment (relay) 711

Appleton – 265 W. Northland Avenue (zip code 54911-2016
telephone . . . . (920) 832-2727

Eau Claire – State Office Building
718 W. Clairemont Avenue (zip code 54701-4558)
telephone . . . . (715) 836-2811

In addition to the above offices, the department has branch of throughout Wisconsin that provide assistance on a limited sche (generally Mondays).

Branch offices are located in Green Bay, Oshkosh, Rhinelan Waukesha, Wausau, and Wisconsin Rapids.

SPECIFIC INSTRUCTIONS

Period Covered Use this form to file a 2009 amended retum calendar year 2009 and fiscal years that begin in 2009. For a fi year, a 52-53 week period, or a short-period return, fill in the able year beginning and ending dates in the taxable year spac the top of the form. If your return is for a fiscal year, a 52-53 w period, or a short-period, also fill in "11" in the Special Conditi box located to the right of the name and address section on pag on Form 1X.

Social Security Number, Name, and Address Fill in your so security number, legal name, and current address. If you are m ried filing a joint return, fill in the social security numbers and le names of both spouses.

If you are married filing a separate return, fill in your legal na on the appropriate line. Also fill in your spouse's legal name in space provided on the last line of the name and address a Fill in your spouse's social security number in the space provi above the name area.

Filing Status Check the space to indicate your filing status your original 2009 return, and check to indicate your filing sta on this amended return. If you are changing from separate retu to a joint return, both of you must sign Form 1X. If there is any due, it must be paid in full.

Caution You cannot change from a joint to separate returns a the due date for filing your original return has passed.

Special Conditions Certain persons have to enter informatio the Special Conditions section. Below is a list of the special co tion codes that you may need to enter in the Special Conditio box on Form 1X. Be sure to read the instruction on the page lis for each code before using it. Using the wrong code or not usin code when appropriate could result in an incorrect tax computat or a delay in processing your return.

04	Divorce decree (page 5)
05	Injured spouse (page 5)
11	Fiscal filers (page 1)
99	Multiple special conditions

- **Wire Gauge:** remember the higher the number, the thinner the wire. E.g., #30 wire is thinner than #26 wire.
- One turn:
    - For toroids, one turn is a single pass through the center hole.
    - For binocular cores, one turn is a pass in which the wire goes in the bottom, comes out the top, goes back in the other hole at the top, and comes out the other hole at the bottom.
- Bi (tri) filar means 2(3) equal lengths of wire. You get the bi(tri)filar strand by taking the length of wire specified for the primary winding, folding it into half(thirds), twisting it to 3~ twists per inch, and winding it over the primary winding. One end of such a strand will have two(three) leads; the other end will have a "hairpin" bend (and a single lead in the case of tri-filar).
- Multi-filar windings are usually done AFTER the uni-filar winding is done.
- Windings shoud be evenly spaced and ideally made such that the winding covers ~345 degrees of the toroid
- Inductance values given are for the single (uni-filar) winding. They are provided to help verify turn counts and core material selected.
- Toroid nomenclature provides the outside diameter of the toroid (in hundredths of an inch - the "30" in "T30-2"), and material code (the "2" in "T30-2"). Color codes used in these kits are:
    - 2=Red
    - 3=Gray
    - 6=Yellow
    - 7=White
    - 10=Black
    - 12=Green (with White on opposite side)

Inductors In This Step

L10

COIL: 4.6uH: 32T #27(18in) on T30-2(red)
Using approximately 19 inches of 27 wire, wind 32 turns on a 0.30 inch od T30-2(red) ferrite. Inductance = 4.60 uH.

L11

COIL: 1.3uH: 17T #27(11in) on T30-2(red)
Using approximately 12 inches of #27 wire, wind 17 turns on a 0.30 inch od T30-2(red) ferrite. Inductance = 1.30 uH.

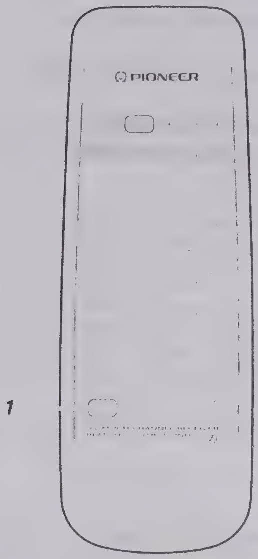
L12

COIL: 4.6uH: 32T #27(18in) on T30-2(red)
Using approximately 19 inches of 27 wire, wind 32 turns on a 0.30 inch od T30-2(red) ferrite. Inductance = 4.60 uH.

First, you want to wind and install the coils and then continuity test them. The continuity test checks for continuity between the points labeled "1" and then tests the continuity between the points labeled "2". Wherever possible, the test points have been assigned to vias removed from but electrically connected to the coils' vias, so as to give a good test of the soldering.

RECORDING

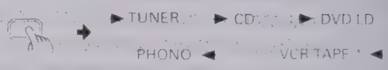
Recording with TAPE 1 or TAPE 2



memo

- Turn OFF TAPE 2 MONITOR when recording with TAPE 1
- Turn ON the power of all equipment to be used.

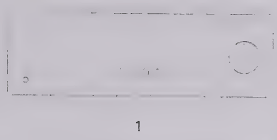
1. **Select the source to be recorded.**



2. **Start recording with TAPE 1 or TAPE 2.**

3. **Play back the source to be recorded.**

■ Operating with the main unit



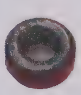
1. **Select the source to be recorded using the Function button.**
2. **Start recording with TAPE 1 or TAPE 2.**
3. **Play back the source to be recorded.**

memo

- The VCR TAPE 1 sounds cannot be recorded with TAPE 1
- The volume, tone, balance and surround setting of this unit have no effect on the recording signal
- The TAPE 2 sounds cannot be recorded

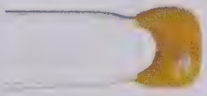
■ Recording Monitor

When recording with TAPE 2, if the recording device connected has a recording monitor function, turning ON the TAPE 2 MONITOR button will enable recording to be carried out simultaneously with playback monitoring (the TAPE 2 indicator lights)

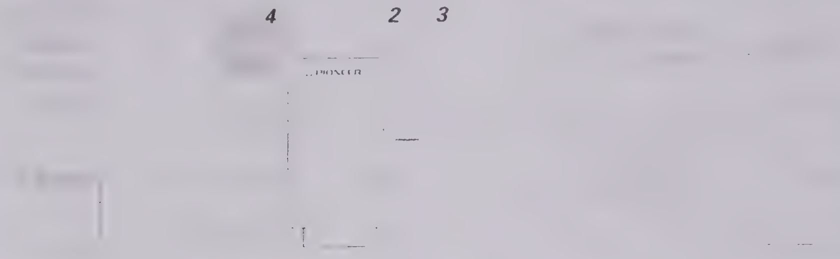
Check	Designation	Component (top/bottom)	Orientation	Marking	Image	Band	Notes
☐	L10	4.6uH: 32T #27(18in) on T30-2(red) (top)		red	4.6uH: 32T #27(18in) on T30-2(red)	LF	was #30
☐	L10-core	T30-2 toroid core (top)		red		LF	0.30" (7.62mm) outside diameter core
☐	L11	1.3uH: 17T #27(11in) on T30-2(red) (top)		red	1.3uH: 17T #27(11in) on T30-2(red)	LF	was #30
☐	L11-core	T30-2 toroid core (top)		red		LF	0.30" (7.62mm) outside diameter core
☐	L12	4.6uH: 32T #27(18in) on T30-2(red) (top)		red	4.6uH: 32T #27(18in) on T30-2(red)	LF	was #30
☐	L12-core	T30-2 toroid core (top)		red		LF	0.30" (7.62mm) outside diameter core

Install the Band 3 Static Components

Once you have successfully verified continuity, you can proceed to install the remaining parts for the passband.

Check	Designation	Component (top/bottom)	Orientation	Marking	Image	Band
☑	C17	1000 pF 5% (top)	vert	102		LF

Memorizing Desired Stations (Main unit only)



memo

- The frequency received and MPX MODE (FM only) can be memorized
- Up to 10 stations can be memorized in each of three classes

1. **Receive the desired station.**

Refer to "LISTENING TO FM AM BROADCASTS (P.20, 21)

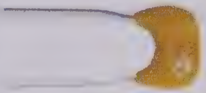
2. **Set the MEMORY mode.**

3. **Select the desired class number.**

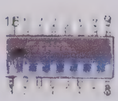
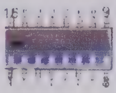
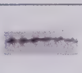
4. **Select the desired station number.**

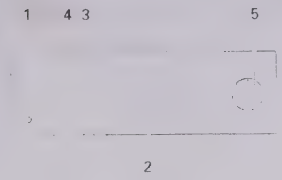
The selection will be memorized in the specified station number 5 seconds later. Pressing the MEMORY button within 5 seconds will exit the MEMORY mode

Repeat steps 1 to 4 to memorize up to 30 stations

☑	C18	3300 pF 5% (top)	horiz	332		LF
☑	C19	1000 pF 5% (top)	horiz	102		LF

Install Bottomside Components

Check	Designation	Component (top/bottom)	Orientation	Marking	Image	Band	Notes
☐	U08	FST3253 mux/demux switch ((bottom))		FST3253 **ESD!!!**		any	
☐	U09	FST3253 mux/demux switch ((bottom))		FST3253 **ESD!!!**		any	
☐	C37	0.1 uF ((bottom))	white pads	(smt) black stripe		any	
☐	C38	0.1 uF ((bottom))	white pads	(smt) black stripe		any	
☐	C39	0.1 uF ((bottom))	white pads	(smt) black stripe		any	
☐	C40	0.1 uF ((bottom))	white pads	(smt) black stripe		any	
☐	C41	0.1 uF ((bottom))	white pads	(smt) black		any	



■ Selecting a broadcast station using the main unit

1. **Press the STANDBY/ON button.**
2. **Press the FM/AM button and select an FM or AM broadcast.**
3. **Press the TUNING SELECT button to set the frequency mode.**

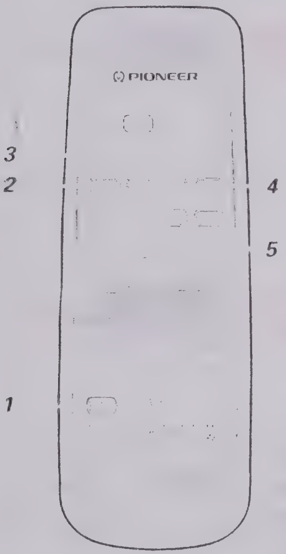
   ► FREQUENCY mode
   FM 87.50*
   STATION mode ◄
   A1 87.50*
   *: Display

4. **Press the FREQUENCY –,+ button and select the broadcast station.**
   The TUNED indicator lights when broadcast is received
5. **Adjust the volume**

memo

The TUNED indicator will not light when a broadcast station is too far away or when the broadcasting signal is weak

Directly inputting the frequency [Direct Access (remote control unit only)]



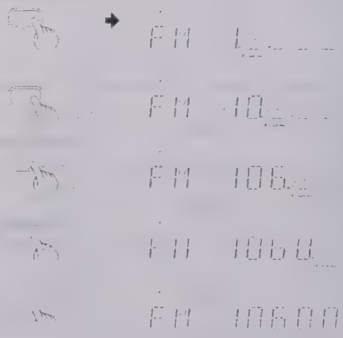
1. Set the TUNER function.

2. Select the TUNER operations.

3. Select the BAND (FM or AM).

4. Set the direct access mode.

5. Select the broadcast station.
Press the numbers of the frequency to be received in order.

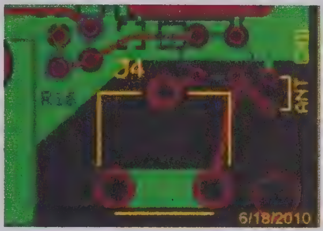


■ Canceling the frequency input

The frequency input can be canceled by pressing the D.ACCESS button again Input the frequency again correctly

				stripe			
☐	C42	0.1 uF ((bottom))	white pads	(smt) black stripe		any	

Install Antenna Jack



Note that there is an optional grounding via for the return side of the antenna connection. Normally, you would NOT want to ground this to regular circuit ground. However, there is some further discussion of this issue in this message thread in the Softrock40 reflector. One message suggested substituting a 4.7k ohm resistor for the grounding jumper to eliminate 60 Hz hum in the rx.

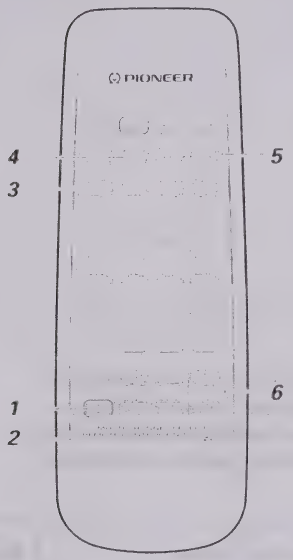
Check	Designation	Component (top/bottom)	Orientation	Marking	Image	Band	N
☐	J04	BNC Connector Male - PCB mount (top)				any	
☐	jmpr_ant	shunt wire (cut-off lead) (top)				any	(s n

}

Completed Photos

View of Completed Topside

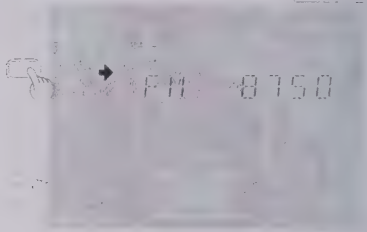
LISTENING TO FM/AM BROADCASTS



1. Turn ON the power of the receiver.

→ STANDBY indicator goes off

2. Set the TUNER function.



3. Select the TUNER operations.

4. Select the BAND. (FM or AM)

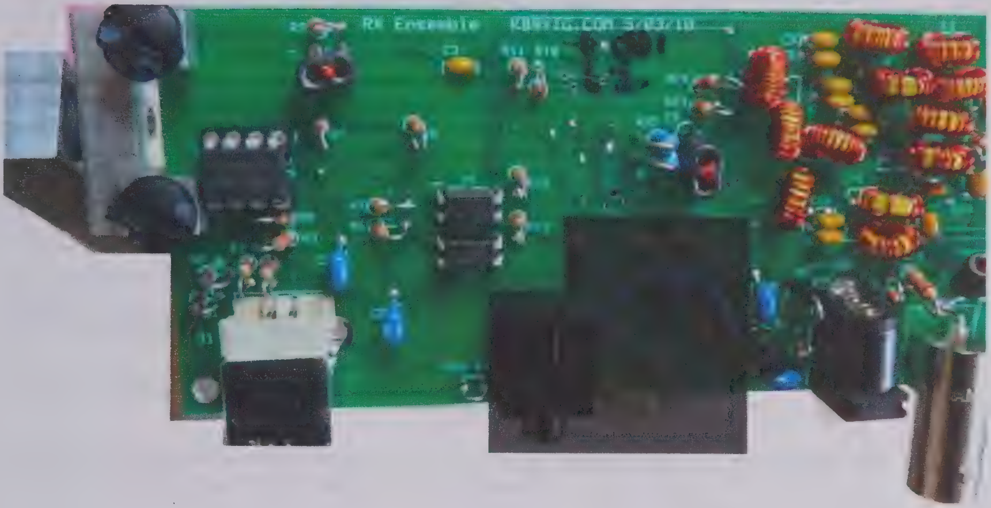
5. Select the broadcast station.

→ Refer to "Selecting broadcast station" below

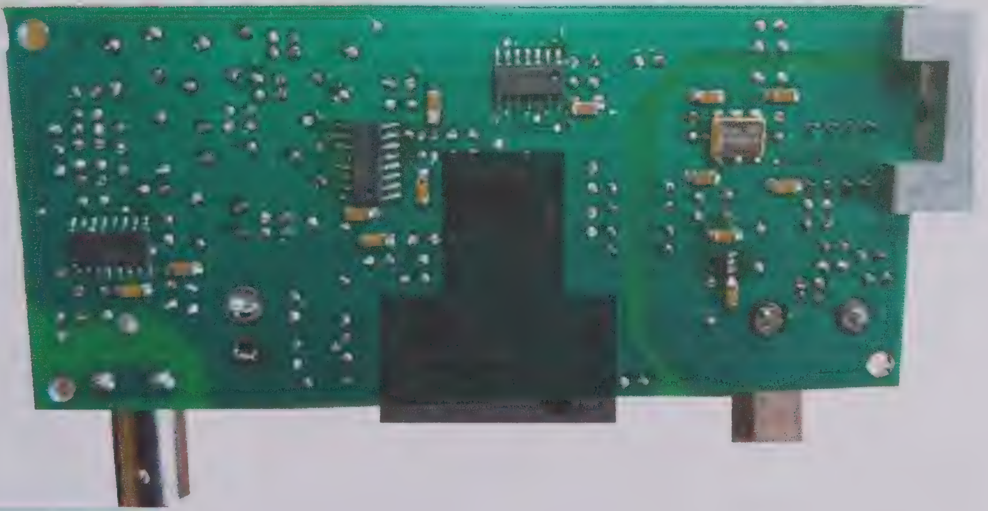
6. Adjust the volume

Selecting broadcast stations (For example, when selecting an FM broadcast)

Selecting step by step.	Selecting automatically.	Selecting at high speed
Press lightly and release.	(Press and hold for approx. 1 second, then release)	Press continuously
↓	↓	↓
87.50 87.60 87.70 ⋮	87.50 ↓ 89.50 Stops when received.	87.50 87.60 ⋮ 89.50 Stops when released



View of Completed Underside



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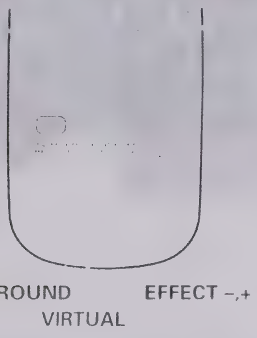
Test the Auto Band Pass Filters Stage

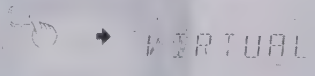
Auto Band Pass Filters - Voltage

Switching the DOLBY VIRTUAL

This unit is equipped with a DOLBY VIRTUAL function which realizes virtual surround effects using two FRONT speakers in addition to DOLBY PRO LOGIC and DSP modes.
Actually the sounds are output only from the two FRONT speakers, however it would seem as if sounds are also being produced from the back.



Select DOLBY VIRTUAL.
DOLBY VIRTUAL will turn ON and OFF each time this button is pressed.

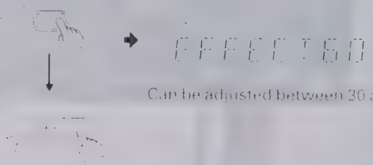


■ Operating with the main unit

Press the DOLBY VIRTUAL button.
DOLBY VIRTUAL will turn ON and OFF each time this button is pressed.

The virtual surround level can be adjusted as desired.

Adjust the virtual surround level.



Can be adjusted between 30 and 90.

Note

- The initial value of EFFECT LEVEL is 60
- The DOLBY VIRTUAL effects differ considerably according to the source played back. Use it to play back music and movie discs encoded by DOLBY PRO LOGIC.
- The DOLBY VIRTUAL effects differ considerably according to the listening position. See P.29

Divider Tests

With Power and USB connected, test the output of the three voltage dividers in this stage. Each should yield approximately one-half the voltage on the 5V rail.

Trouble-Shooting the Voltage Dividers

If either of the two voltage dividers does not yield the expected value, check to be certain that the resistors are all 2.2K (red-red-red-gld). You may also want to use the Utility Voltage Divider Calculator to plug in your actually measured voltage and calculate the resistor values that would cause your unexpected result.

Trouble Shooting R15/R16

Assuming you have the correct resistors and you are getting near zero at the junction, look for something that could short that junction to ground:

- C37
- T2 (windings shorted together)
- soldering on R16

Trouble Shooting R23/R24

Assuming you have the correct resistors and you are getting near zero at the junction, look for something that could short that junction to ground:

- C40
- T3 (windings shorted together)
- soldering on R24

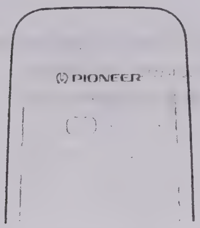
Trouble Shooting R28/R27

Assuming you have the correct resistors and you are getting near zero at the junction, look for something that could short that junction to ground:

- C42
- C41
- soldering on R28

Setting the EFFECT Level

Surround effects can be changed by adjusting the EFFECT level in the DSP mode

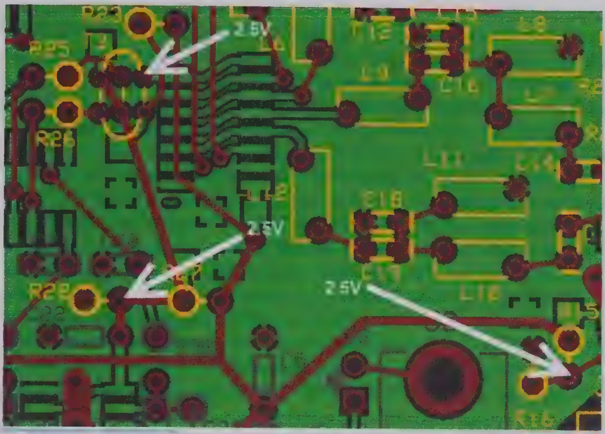


1. Select the DSP mode.

►HALL ►JAZZ ►DANCE

DSP OFF◄ THEATER 2◄ THEATER 1◄

2. Adjust the EFFECT



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Test Steps (if any)

Step	Test Point	UOM	Nominal	Author's	Builder's
1	R15 Hairpin lead (R15/R16 voltage divider)	V dc	2.5	2.47	2.5
2	Either of the Primary leads of T3 (R23/R24 voltage divider)	V dc	2.5	2.47	2.5
3	R28 Hairpin lead (R27/R28 voltage divider)	V dc	2.5	2.47	2.5

ok

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Auto Band Pass Filters - Pin Voltages on the Ics

Run the Filter Selection Test from the LO and Control Stage, only instead of measuring the voltages at the hairpin leads of R12 and R13, measure the voltages at the 2 and 14 PINS (not the pads) of U8 and U9. This will validate that the pins were correctly soldered to the pads and are getting the switching signals.

Perform the tests below for each of U8 and U9

<dagga.mara@gmail.com>, "'dagel@wisc.edu'"
<dagel@wisc.edu>, "'dailey@terracom.net'"
<dailey@terracom.net>, "'dajahnen@sbcglobal.net'"
<dajahnen@sbcglobal.net>,
"'dalton4873@sbcglobal.net'"
<dalton4873@sbcglobal.net>,
"'damian@damianfloring.com'"
<damian@damianfloring.com>,
"'danawi83@hotmail.com'"
<danawi83@hotmail.com>,
"'daniel.wilson@wisconsin.gov'"
<daniel.wilson@wisconsin.gov>,
"'danielomom@yahoo.com'"
<danielomom@yahoo.com>, "'danna-
olsen@yahoo.com'" <danna-olsen@yahoo.com>,
"'danwyprk@aol.com'" <danwyprk@aol.com>,
"'darcelin@chorus.net'" <darcelin@chorus.net>,
"'dave_grundgeiger@codenouveau.com'"
<dave_grundgeiger@codenouveau.com>,
"'dave@glowacki.org'" <dave@glowacki.org>,
"'davedonovan@charter.net'"
<davedonovan@charter.net>,
"'davegrosser@gmail.com'"
<davegrosser@gmail.com>,
"'davidfoxrn@charter.net'"
<davidfoxrn@charter.net>,
"'davidhilda@hotmail.com'"
<davidhilda@hotmail.com>,
"'davidpwalther@charter.net'"

"'diane_calhoun@usgs.gov'"
<diane_calhoun@usgs.gov>,
"'dianebh@sbcglobal.net'"
<dianebh@sbcglobal.net>,
"'dianestevens@charter.net'"
<dianestevens@charter.net>,
"'digitael999@yahoo.com'"
<digitael999@yahoo.com>, "'dillaway@wisc.edu'"
<dillaway@wisc.edu>, "'dipesh@navsaria.com'"
<dipesh@navsaria.com>, "'dirkx@ssec.wisc.edu'"
<dirkx@ssec.wisc.edu>, "'dj_carr@earthlink.net'"
<dj_carr@earthlink.net>, "'djb@bogen.org'"
<djb@bogen.org>, "'djhphoto@hotmail.com'"
<djhphoto@hotmail.com>, "'djmeicher@wisc.edu'"
<djmeicher@wisc.edu>, "'djray5@sbcglobal.net'"
<djray5@sbcglobal.net>, "'djvos@chorus.net'"
<djvos@chorus.net>, "'djyelle@wisc.edu'"
<djyelle@wisc.edu>, "'dkl@chorus.net'"
<dkl@chorus.net>, "'dklann05@sbcglobal.net'"
<dklann05@sbcglobal.net>, "'dkoch99@charter.net'"
<dkoch99@charter.net>, "'dlbl-
dlbl@stanfordalumni.org'" <dlbl-
dlbl@stanfordalumni.org>,
"'dleathers11@hotmail.com'"
<dleathers11@hotmail.com>, "'dleyerle@usa.net'"
<dleyerle@usa.net>, "'dlillge@yahoo.com'"
<dlillge@yahoo.com>,
"'dmaetensen@edgewood.edu'"
<dmaetensen@edgewood.edu>,

If you are building the LF option, you will need to changet the frequencies to ones that are within the pass band of each filter:

LF Corner HF

Band	Midband (kHz)	Corner		Corner
Band 0	330	0.4	2 MHz	4
Band 1	600	.8	6	8
Band 2	1200	1.6	12	16
Band 3	2300			

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Test Steps (if any)

Step LF	Test Point	UOM	Nominal	Author's	Builder's
1	LO=2 MHz (band 0) - Test pin 2 (FL SEL 1)	Vdc	< 200mV	100 mV	
2	LO=2 MHz (band 0) - Test pin 14 (FL SEL 0)	Vdc	< 200mV	100 mV	
3	LO=6 MHz (band 1) - Test pin 2 (FL SEL 1)	Vdc	< 200mV	100 mV	
4	LO=6 MHz (band 1) - Test pin 14 (FL SEL 0)	Vdc	>3	4.92	
5	LO=12 MHz (band 2) - Test pin 2 (FL SEL 1)	Vdc	>3	4.92	
6	LO=12 MHz (band 2) - Test pin 14 (FL SEL 0)	Vdc	< 200mV	100 mV	
7	LO=24 MHz (band 3) - Test pin 2 (FL SEL 1)	Vdc	>3	4.92	
8	LO=24 MHz (band 3) - Test pin 14 (FL SEL 0)	Vdc	>3	4.92	

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<delross@tds.net>, "'denhar@tds.net'"
<denhar@tds.net>, "'denisdrake@tds.net'"
<denisdrake@tds.net>,
"'dennismaxine@yahoo.com'"
<dennismaxine@yahoo.com>,
"'denny22257@yahoo.com'"
<denny22257@yahoo.com>,
"'derekt28@yahoo.com'" <derekt28@yahoo.com>,
"'detcheverry@wisc.edu'" <detcheverry@wisc.edu>,
"'dettmdj@dhfs.state.wi.us'"
<dettmdj@dhfs.state.wi.us>, "'devault@chorus.net'"
<devault@chorus.net>, "'devogel@wisc.edu'"
<devogel@wisc.edu>,
"'devorah_sherman@hotmail.com'"
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"'dferust@facstaff.wisc.edu'"
<dferust@facstaff.wisc.edu>,
"'dfix@oakparkplace.com'"
<dfix@oakparkplace.com>, "'dhammer@chorus.net'"
<dhammer@chorus.net>, "'dhar@wisc.edu'"
<dhar@wisc.edu>, "'dhill@doit.wisc.edu'"
<dhill@doit.wisc.edu>, "'dhseligman@whs.wisc.edu'"
<dhseligman@whs.wisc.edu>,
"'dhub7@netscape.net'" <dhub7@netscape.net>,
"'dhuppler@soemadison.wisc.edu'"
<dhuppler@soemadison.wisc.edu>,
"'dhvidruk@facstaff.wisc.edu'"
<dhvidruk@facstaff.wisc.edu>,
"'diane@engr.wisc.edu'" <diane@engr.wisc.edu>,

Auto Band Pass Filters - (Optional) RF Test

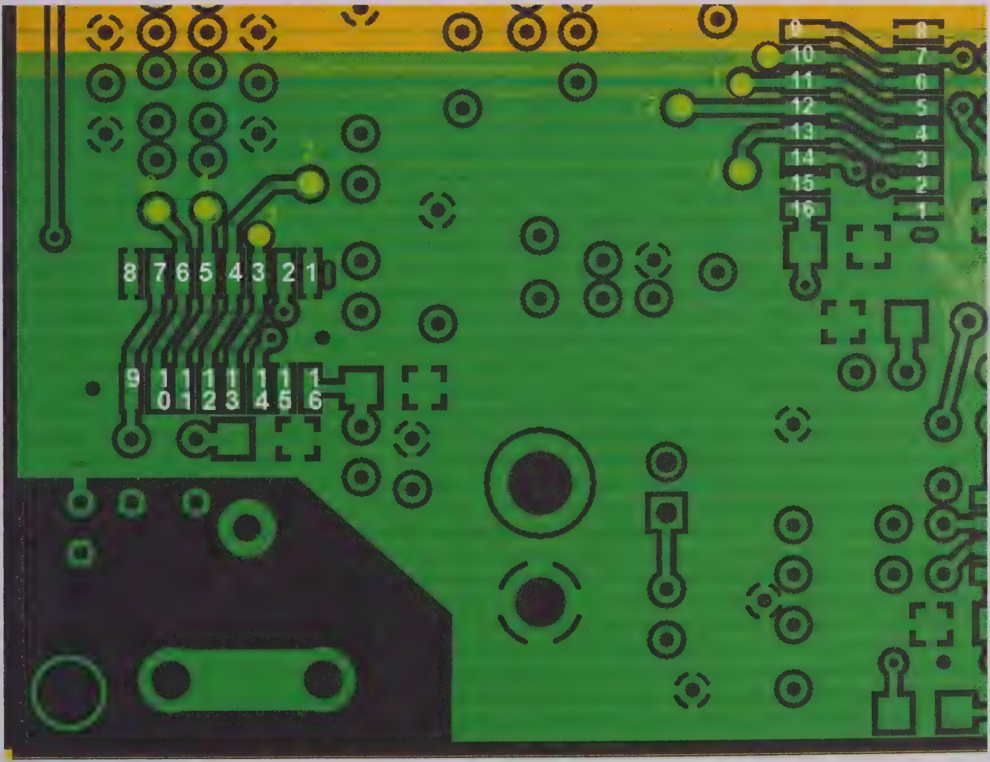
If you have a scope and a signal source (or an RF probe and a signal source)

Inject an RF signal of around 50-100 mV at the antenna jack, determine which band should switch for that RF signal, and probe the pins of U8 and U9 which should be switched to that signal:

Band	Switched Pins
Band 0 (1-4 MHz)	6 & 10
Band 1 (4-8 MHz)	5 & 11
Band 2 (8-16 MHz)	4 & 12
Band 3 (16-30 MHz)	3 & 13

Adjust the frequencies above if you are building the LF kit

Your scope should show the signal at the switched pins and not at any of the other pins.



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<bonniegruber@tds.net>, "'bonniejeann@yahoo.com'" <bonniejeann@yahoo.com>, "'bowen2@wisc.edu'" <bowen2@wisc.edu>,
"'bpark4@2wisc.edu'" <bpark4@2wisc.edu>, "'bpavi99@charter.net'" <bpavi99@charter.net>, "'bpfarley12@hotmail.com'"
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"'brandonkuhl@yahoo.com'" <brandonkuhl@yahoo.com>, "'brbrewst@wisc.edu'" <brbrewst@wisc.edu>, "'brdobie@yahoo.com'"
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<briandiedtuesday@aol.com>, "'briangarthwaite@lycos.com'" <briangarthwaite@lycos.com>, "'briansprague_1999@yahoo.com'"
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"'brookegodfry@yahoo.com'" <brookegodfry@yahoo.com>. "'brsteele@wisc.edu'" [illegible] "'bruce.aunet@dot.state.wi.us'"
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Test Steps (if any)

Go to Top of Page

Next Stage: Mixers

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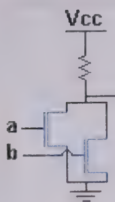
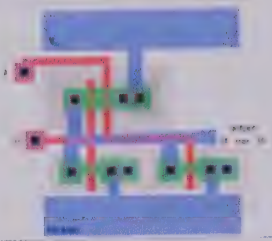
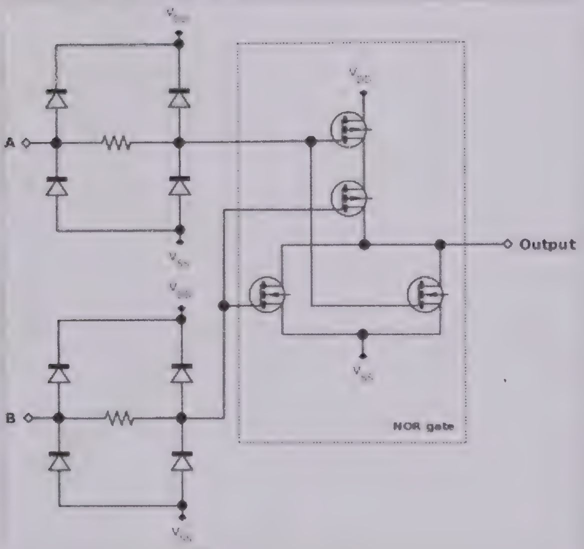


NMOS NOR gate



The physical layout of a CMOS NOR

This diagrams above show the construction of a 2-input NOR gate using NMOS circuitry. If either of the inputs are high, the corresponding NMOS is turned on and the output is pulled low; otherwise the output is pulled high through the pull-up resistor. The diagram below shows a 2-input NOR gate using CMOS technology. The diodes and resistors on the inputs are to protect the CMOS components from damage due to electrostatic discharge (ESD) and play no part in the logical function of the circuit.



Unbuffered CMOS two input NOR gate

Alternatives

WB5RVZ.Org - Ensemble HF/LF RX II

Register Login

Home Bands Power Supply USB Power LO Dividers BPFs QSD Op Amps BOM BOM X-Ref Inventory Revisions as of 6/20/2013 WB5RVZ

Ensemble RX II (HF/LF) Quadrature Sampling Detector

Band: LF

Introduction

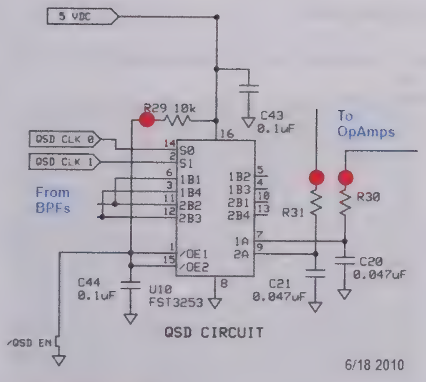
Band Specific Components

This stage involves band-specific components and is currently configured for the LF band. If you need to configure this page for a different band, click on the "Band" tab in the menu above. This would take you to the home page, where you can select the new band and then return to this page.

General Info About the Stage

Theory of Operation

Stage Schematic

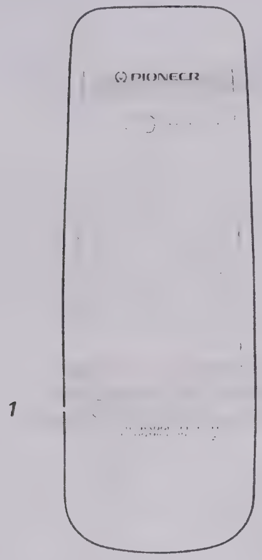


Go to Top of Page

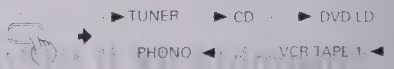
Click here for full schematic

(Red dots represent the "hairpin" (or left-hand or topmost) lead of the component)

Recording with a VCR



1. Select the source to be recorded.



2. Start recording with a VCR.

3. Play back the source to be recorded.

■ Operating with the main unit

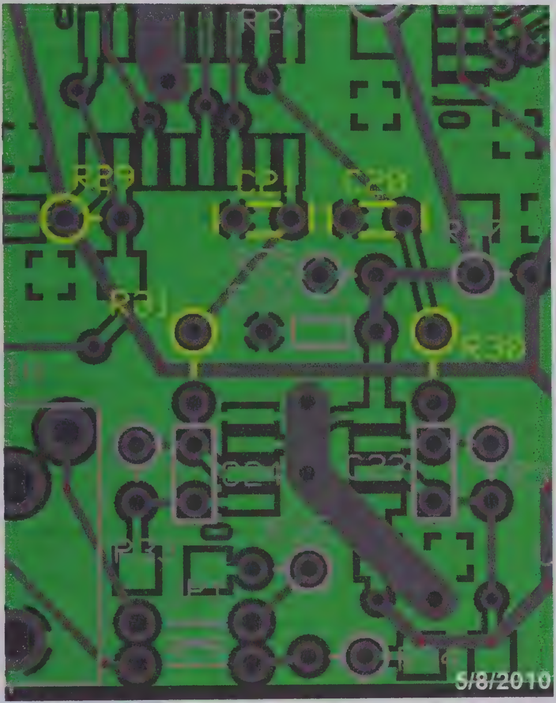
1. Select the source to be recorded using the Function button.
2. Start recording with VCR.
3. Play back the source to be recorded.

memo

- The signal from VCR TAPE 1 cannot be recorded
- The volume, tone, balance, and surround setting of this unit have no effect during recording signal

Board Layouts

Board Top



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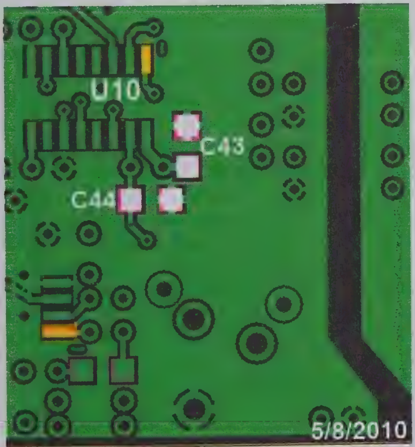
Board Bottom



Any information you provide us will be securely handled and stored and will not be used for any purpose other than for which it was intended.

Terms of Carriage

By accepting or using a ticket or by embarkation on the vessel, the Passenger (which term includes all travelers on the ticket and/or in the party) agrees that the transportation provided for herein shall be subject to and governed by all Terms, Conditions and Regulations (hereinafter the "terms") printed on the ticket or posted in the terminal or onboard the vessel. The terms of the ticket shall apply to ancillary contrasts of service made or provided during or in connection with the performance of the contract herein and evidenced by the ticket

A. Liability -- (a) Lake Express ("the Carrier") shall not be liable for any loss including loss of life, injury, delay, inconvenience or expense suffered by any Passenger, nor for any loss of or damage or delay to Passenger's baggage, vehicle (which includes automobile, truck, motorcycle, trailer or other wheeled conveyance) or other property whether such loss, injury, delay, inconvenience, expense or damage arises from the act, default, neglect, or error of judgment of the Master, Officers, Crew, Managers, Superintendent or other servant or agent of the vessel or any other person whatsoever or whether from or after un-seaworthiness or unfitness of the vessel or any launch, tender or other craft or gangway, landing, stage or land conveyance or from or after any variation or omission of any part of the advertised program of the contract voyage or departure or otherwise howsoever and whether such act, default, neglect, error of judgment, un-seaworthiness, unfitness, detention, delay, deviation, over-carriage, omission, variation or other event occurs before or in the course of the present contract voyage or departure or before or in the course of embarkation at the beginning of the contract voyage or departure or in the course of disembarkation at the end of the contract voyage or departure or while the Passenger is proceeding to the shore, which may take place during or in connection with the contract voyage or departure of at any other time whatsoever during, prior to, or subsequent to the contract voyage or departure when the Carrier would, apart from this clause, be under a contractual or other obligation to the Passenger. (b) The Carrier is not liable for consequential and indirect damages nor for damages arising from delays regardless as to how caused. (c) The liability of the Carrier is restricted to the period in which the Passenger, vehicle and or luggage is actually on the vessel, or on the Carrier's auxiliary vessel. All other transportation and associated services (e.g. carriage on the vessel or tender not owned or operated by the Carrier, other transportation media, shore excursions, hotel accommodation) are at the risk of the Passenger and are respectively subject to the terms and conditions of those persons and organizations supplying such services. The acceptance of money relative to such services does not constitute acceptance by the Carrier of liability

B. Passenger injury -- a) The Carrier shall not be liable for damage suffered as a result of the death of or personal injury to a Passenger unless the incident which caused the damage so suffered occurs in the course of the carriage and was due to the fault or the neglect of the Carrier or of his servants or agent acting within the scope of their employment

C. Burden of Proof -- (a) The burden of proving that the incident which caused the damage or loss occurred in the course of the carriage and the extent of the damage or loss lies with the Passenger. (b) The burden of proving the fault or neglect of the Carrier or its servants or agents lies with the Passenger, unless the damage or loss arises from or in connection with shipwreck, collision, stranding, explosion or fire

D. Notice of damage -- (a) The Passenger is required to report any personal injury and/or all other losses and/or damages to baggage forthwith, latest by disembarkation - in writing and with full details, to the Master or his/her representative. If the personal injury or damage is not externally discernible, it will suffice if the notification is tendered within 15 days after disembarkation. (b) Where notification is received late, it will be presumed that at the time of disembarkation, the Passenger was uninjured, no losses were incurred and luggage undamaged.

E. Passengers fitness to sail -- (a) If any Passenger for any reason whatsoever including (but not limited to) sickness, disease injury or infirmity, physical or mental, appears to the Carrier or to the Master or his/her agent to be, in their sole discretion, Unfit to proceed, likely to endanger health, discipline or safety onboard or likely to incur injury him/herself or, likely to render the Carrier liable for his/her maintenance or support; then in such case the Carrier may at its option either. i) Refuse to embark such Passenger or ii) Disembark him/her at any port. In case the Passenger is refused embarkation or is disembarked, his/her passage money shall be refunded and the Carrier shall not be liable for any loss or expense occasioned to the Passenger thereby

F. Alcoholic Beverages, Food -- Passengers are not permitted to bring into the passenger cabin any alcoholic liquors or other beverages or food during the voyage. Food, alcohol and other beverages can be purchased on board and brought food, alcohol or other beverages must be left ashore or on the vehicle deck.

G. Fares -- The Carrier reserves the right to levy a surcharge on or make an allowance from the price agreed to be paid or already paid by the Passenger to reflect any change in the cost of fuel since the date of ticket purchase

H. Voyage modification and substitute transportation -- the Carrier has the liberty, without previous notice. (a) At the port of embarkation or any other port, whether an intended port of call or a port of refuge, to cancel the contract herein contained. (b) To delay or cancel any departure. (c) At the port of embarkation or at any other stage whatsoever of the voyage and at the sole risk of the Passenger, to forward the Passenger and or his/her baggage to the port of destination by any other vessel, craft or conveyance whatsoever and whether by land, water, or air and whether belonging to the Carrier or not and by any route direct or indirect

I. Deviations -- The vessel has liberty to tow and assist other vessels and persons in all situations, deviating from the voyage to proceed by any route whatsoever, to call, stay at, and return to any ports whatsoever (including the port of embarkation) whether in, out, or beyond the customary or advertised route to the port of destination, for any purpose whatsoever, to sail with or without a Pilot, to adjust compasses, and to carry cargo of all descriptions, all as part of the contract voyage.

J. General average -- The Passenger is not liable in respect of this baggage or personal effects to pay or entitled to receive any General Average contribution.

K. Compliance with Government and/or Master's orders and rules -- The vessel will have the liberty to comply with any orders or directions as to departure, arrival routes ports of call ,stoppages, transshipment, discharge, or destinations or otherwise, howsoever given by any Government or any Department thereof or of any person acting or purporting to act with the authority of any Government or any Department thereof or by any War Risk Insurance Association or Underwriters with whom the vessel may be insured and anything done or not done under such orders shall be part of the contract voyage

Passengers are obliged to follow all regulations and rules of safety of discipline and to behave properly. The Master is fully authorized to take whatever steps to his/her discretion to arrest or to put under custody a miscreant Passenger or Passenger creating a hazard to the navigation of the vessel.

L. Time tables -- Every effort will be made to adhere punctually to the advertised dates and times of departure from and arrival at terminals and intermediate ports, but these and any dates and times specified in Time Tables which may be issued by the Carrier or the appointed Agents are only approximate and may be altered by the Carrier at any time and to such extent as is considered necessary in the interest of the voyage as a whole.

M. Luggage -- All checked baggage should be packed in substantial luggage, fastened securely with case locks and strapped or roped to give added protection against damage and clearly labeled with the Passenger's name and address

N. Competent jurisdiction court -- Any action, suit or proceeding against the Carrier or the vessel shall, unless the Carrier otherwise expressly agrees in writing, be brought in the State of Wisconsin to the exclusion of all other jurisdiction

O. Applicable law -- Any Ticket and this contract or contracts arising from its acceptance and any dispute between Passenger and Carrier arising out of the purchase of this Ticket, the execution of the contract provided therein, or anything done by the Carrier pursuant to the provisions thereof or in connection with the adjustment or resolution of any disputes arising hereunder, shall be governed by the Law of the State of Wisconsin to the exclusion of any other law unless the Carrier expressly agrees otherwise in writing. Passengers and their vehicles and baggage may be subject to search in compliance with U.S. Federal and U.S. Coast Guard laws and regulations. The Carrier reserves the right to deny carriage to Passengers who refuse to submit to such searches

P. Invalidity of individual clauses -- Each of the provisions contained in these Conditions shall be severable and if any of such Provisions should be invalid, illegal or unenforceable, the remaining provisions shall nevertheless have full force and effect

Q. Limitation of Statutory Claims -- The exemptions and limitations of liability contained in these conditions apply to all claims for damages of the Passenger irrespective as to whether same are based on the Passenger contract or other legal principles.

R. Caution to Passengers. Goods of a Dangerous Nature -- The Carrier will not receive on board of its vessels any goods of a dangerous nature. If any such goods are shipped without notice, the Passenger will not only be liable to the penalties imposed by Statute but also for all damage sustained in consequence of such shipment.

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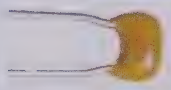
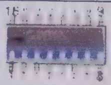
Summary Build Notes

1. Install Bottomside Components
2. Install Topside Components
3. Test the Stage

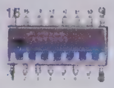
Quadrature Sampling Detector Bill of Materials (LF band option)

Check	Type	Category	Component	Count	Marking	Image
☐	Capacitor	Ceramic	0.047 uF 5%	2	473	
☐	Capacitor	SMT 1206	0.1 uF	2	(smt) black stripe	
☐	IC	SOIC-16	FST3253 mux/demux switch	1	FST3253 ESD!!!	
☐	Resistor	1/4W	49.9 ohm 1%	2	yel-wht-wht-gld-brn	
☐	Resistor	1/6W	10 k 1/6W 5%	1	brn-blk-ora-gld	

Go to Top of Page

Detailed Build Steps

Install Bottomside Components

Check	Designation	Component (top/bottom)	Orientation	Marking	Image	Band	Notes
☐	C43	0.1 uF ((bottom))	white pads	(smt) black stripe		any	
☐	C44	0.1 uF ((bottom))	white pads	(smt) black stripe		any	
☐	U10	FST3253 mux/demux switch ((bottom))		FST3253 ESD!!!		any	Ta ex ca wc wi

rom: "Lake Express" <reservations@lake-express.com>
ject: **Lake Express Reservation Confirmation #2609369**
ate: June 29, 2010 8:52:08 AM CDT
To: "JAMES BEYER" <beyer@engr.wisc.edu>

Current details of your reservation can be viewed online

Lake Express Reservation # 2609369 Confirmation

Reservation Number 2609369 Order Date June 29 2010 Last Update June 29, 2010

Milwaukee to Muskegon July 8, 2010 12:30 PM

CLASSIC - SENIOR (62+)	$68.00	ELAINE BEYER	6213 COUNTRYSIDE LN	608-238-7596
CLASSIC SENIOR (62+)	$68 00	JAMES BEYER	6213 COUNTRYSIDE LN - MADISON	608-238-7596
VEHICLE	$92 00	JAMES BEYER		

Pricing Summary

SubTotal:	$228 00
Port & Security Fees	$16 50
Fuel Surcharge	$15 00
Existing Credit	$0 00
Total:	**$259.50**
Payments	$259.50
Refunds	$0 00

Payment History

PAYMENT TYPE	REFERENCE NUMBER	AMOUNT	DATE
Credit Card	**** ****-****-8472	$259 50	6/29/2010 8 52 AM

Terms and Conditions

Ticket Terms

A Passengers with reservations must arrive 45 minutes prior to scheduled departure.
B Due to homeland security requirements, voyage check-in closes 15 minutes prior to scheduled departure and all outstanding reservations for seats and car slots are void at that time. Lake Express is not obligated to check-in any passenger or vehicle, nor honor any reservation, within 15 minutes of scheduled departure time
C. All passengers, vehicles and baggage are subject to search for security purposes. Anyone refusing such a search will be denied access to the terminal and boarding of the vessel
D Adult passengers must present a valid picture ID prior to boarding the vessel
E. No person under the age of 18 years will be accepted for carriage unless accompanied by a parent or legal guardian
F. Passengers traveling with children under 5 years of age for whom a fare has not been paid may be required to seat the child on the passenger's lap during the voyage.
G. Payment is due in full at the time of purchase and the fare is deemed earned at that time
H. All payments must be made by VISA, MasterCard, or Discover Card credit, or debit card, cash or traveler's checks No personal checks accepted
I Tickets must be used within one (1) year of the date of issuance
J. Changes to reserved tickets may be made and are subject to the payment of a change fee of $10 00 per Child or Adult fare (1-way or roundtrip) covered by the reservation and $5.00 per Vehicle, Motorcycle or Trailer fare (1-way or roundtrip) covered by the reservation
K. Reserved tickets cancelled more than 72 hours prior to the reserved departure time are refundable minus the following cancellation fees
    A. $10 00 cancellation fee per Child fare (1-way or roundtrip) covered by the reservation.
    B. $20.00 cancellation fee per Adult fare (1-way or roundtrip) covered by the reservation.
    C. $30 00 cancellation fee per Adult fare with Vehicle or Motorcycle (1-way or roundtrip) covered by the reservation
L. The fare for a "no show" is deemed forfeited at the time of the "no show" and is non-refundable
M Lake Express reserves the right to cancel any departure. In the event of a Lake Express cancelled departure, the passenger may rebook on a later departure or receive a refund for the unused portions of tickets
N Lake Express reserves the right to have passengers remove bicycles or other racks mounted on a vehicle

Boarding Procedures

For passengers without a vehicle:
When arriving at the terminal, please proceed through the terminal security screening and baggage check-in. After security clearance, go to the ticket counter to be checked in and to receive a Boarding Pass Proceed to the waiting area and you will be called when the vessel is ready to board

For passengers with a vehicle
When arriving at the terminal, drive straight to the vehicle ticketing and staging area. You and your vehicle will be security screened and your reservation processed for check in After receiving your Boarding Pass proceed into the staging area Lake Express yard personnel will direct you when the boarding process begins.

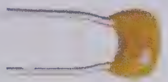
Privacy Statement

co
Al
ES
pr

Install Topside Components

Note: the circuit calls for a jumper for the "QSD EN" (QSD Enable) connection. This was installed during the build of the Power Supply to serve as a convenient ground point for testing in subsequent stages. The purpose of the jumper is to enable RX.

Should you have a situation where you would need to disable RX (e.g., while transmitting on a separate TX device), the jumper can be replaced with appropriate switching mechanisms. For RX only, retain the jumper as installed in the Power Supply stage.

Check	Designation	Component (top/bottom)	Orientation	Marking	Image	Band	Notes
☑	C20	0.047 uF 5% (top)	horiz	473		any	
☑	C21	0.047 uF 5% (top)	horiz	473		any	
☑	R29	10 k 1/6W 5% (top)	W-E	brn-blk-ora-gld		any	was R27
☑	R30	49.9 ohm 1% (top)	N-S	yel-wht-wht-gld-brn		LF	
☑	R31	49.9 ohm 1% (top)	N-S	yel-wht-wht-gld-brn		LF	

Completed Photos

View of Completed Topside

Patient Name: James B Beyer | DOB: 7/7/1931 | PCP: Richard G Schmelzer, MD
Printed on Sunday, May 02, 2010

CK, Total - Historical Results

NOTE: Please be aware that performing lab test locations can have different result ranges. A lab test can only be graphed as an individual lab test result in these cases. If you have questions regarding your lab results please contact the clinic that ordered the lab test.

Chart

Name	CPK
Reference Range	*24-195 u/L*
12/8/2009	119

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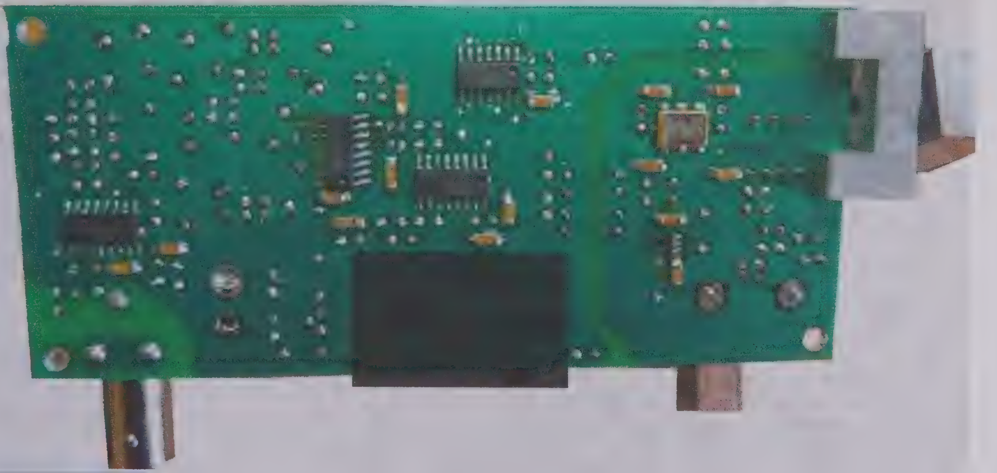
This page was printed on Sunday, May 02, 2010 at 4:54:04 PM.

UW Health, located in Madison, Wisconsin, is an academic health system comprised of the University of Wisconsin Hospital and Clinics, the University of Wisconsin Medical Foundation and the University of Wisconsin School of Medicine and Public Health.

View of Completed Underside



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Test the Quadrature Sampling Detector Stage

Quadrature Sampling Detector - IC Pin Voltages

Test Notes

Automotive AC Parts

- TechChoice Parts

It has been observed before that some digital meters are affected by the square wave signals on IC pins and do not always read correctly. The readings you get should approximate 2.5V . The best instrument may be a good oscilloscope. Just be prepared to see slightly different readings on pins 10-13 and 3-6, depending on your DMM (mine is not the best!)

Be sure you have installed the jumper at /QSD EN (back in the Power Supplt stage). This grounds pin 15, enabling the QSD.

Just for a little background information, most of the voltages on U10 pins are derived from the potential divider formed by R27/28 (tested in the Auto Bandpass Filter Stage). If in doubt you can always measure the junction of those two and should get 2.5v as they are equal values across the 5v rail. If one or both were the wrong value, that point would be significantly different. The 2.5v is passed through T3 to the input pins of the multiplexer, and appear on the output pins when the appropriate switch is enabled. Other pins have clock waveforms present, which are relying on the averaging effects of the measuring instrument to give an approximate reading of 2.5v, but this can vary tremendously.

Conduct the Test

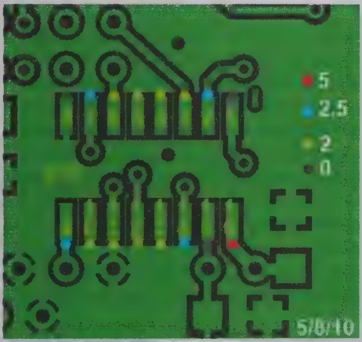
Power the board, connect USB to PC

Voltages are measured WRT (regular) ground (/QSD EN shunt)

Bob G8VOI provided thius note concerning these voltages:

Measure pin voltages

It is best to test for these voltages at the actual pins (not the pads), thereby ensuring correct soldering of the pins to the pads.



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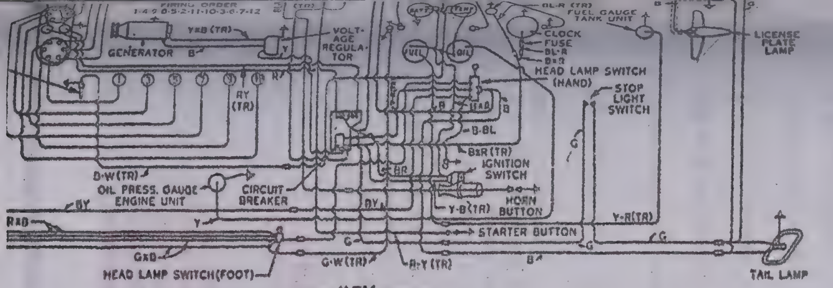
Test Steps (if any)

Step	Test Point	UOM	Nominal	Author's	Builder's
1	Pins 1 and 15 (gnd)	V dc	0	0	
2	Pins 10, 11, 12, and 13 (40% of 5V rail)	V dc	2.5	2.1	
3	Pins 3, 4, 5, and 6 (40% of 5V rail)	V dc	2.5	2.1	



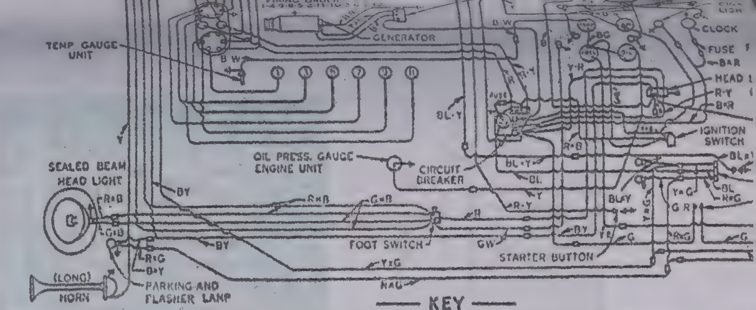
KEY

B = BLACK
R = RED
Y = YELLOW
G = GREEN
BG = BLACK AND GREEN
BR = BLACK AND RED
BY = BLACK AND YELLOW

G·W (TR) = GREEN WITH WHITE TRACER
R·Y (TR) = RED WITH YELLOW TRACER
B·W (TR) = BLACK WITH WHITE TRACER
BL·Y (TR) = BLUE WITH YELLOW TRACER
BL-R (TR) = BLUE WITH RED TRACER
Y-B (TR) = YELLOW WITH BLACK TRACER
B·BL (TR) = BLACK AND BLUE TRACER

G-B (TR) = GREEN WITH BLACK TRACER
Y-R (TR) = YELLOW WITH RED TRACER
Y x B (TR) - YELLOW WITH BLACK CROSS TRACER
R x B (TR) - RED WITH BLACK CROSS TRACER
G x B (TR) - GREEN WITH BLACK CROSS TRACER
B x R (TR) - BLACK WITH RED CROSS TRACER

Lincoln-Zephyr, 1940



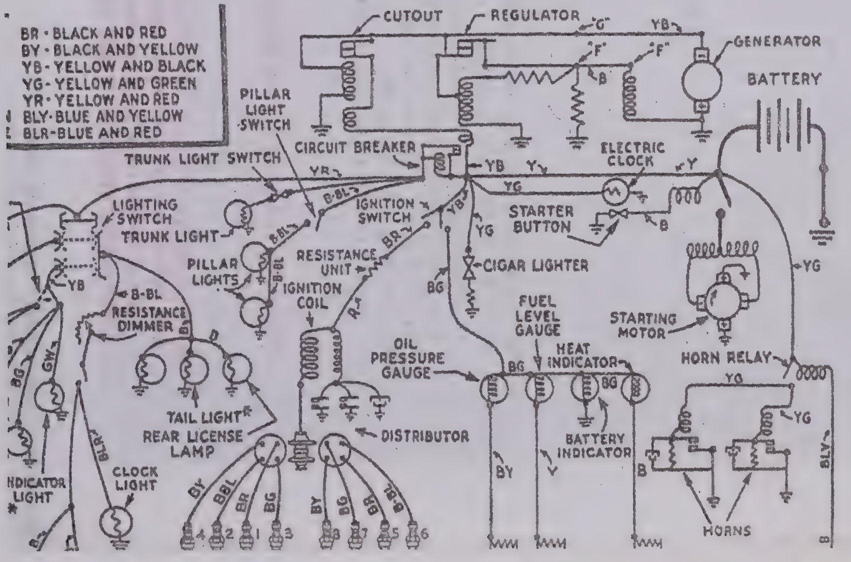
KEY

B = BLACK
BL = BLUE
G = GREEN
R = RED
Y = YELLOW
BG = BLACK AND GREEN
BY = BLACK AND YELLOW

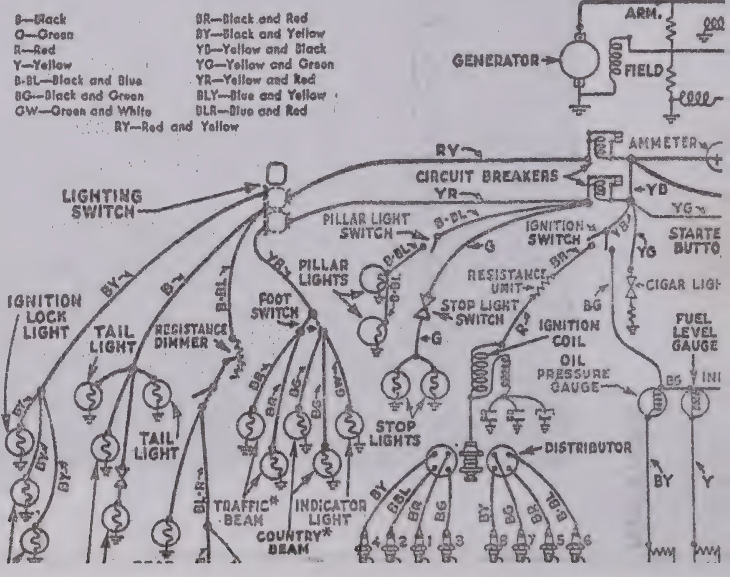
G-W = GREEN WITH WHITE TRACER
B-R = BLACK WITH RED TRACER
B-W = BLACK WITH WHITE TRACER
BL-Y = BLUE WITH YELLOW TRACER
G-B = GREEN WITH BLACK TRACER
R-B = RED WITH BLACK TRACER
R-Y = RED WITH YELLOW TRACER

Y-R = YELLOW WITH RED TRACER
B x BL = BLACK WITH BLUE CROSS TRACER
B x R = BLACK WITH RED CROSS TRACER
B x Y = BLACK WITH YELLOW CROSS TRACER
BL x Y = BLUE WITH YELLOW CROSS TRACER
G x B = GREEN WITH BLACK CROSS TRACER
G x R = GREEN WITH RED CROSS TRACER

Lincoln-Zephyr, 1941



BR - BLACK AND RED
BY - BLACK AND YELLOW
YB - YELLOW AND BLACK
YG - YELLOW AND GREEN
YR - YELLOW AND RED
BLY - BLUE AND YELLOW
BLR - BLUE AND RED



B—Black
G—Green
R—Red
Y—Yellow
B-BL—Black and Blue
BG—Black and Green
GW—Green and White
BR—Black and Red
BY—Black and Yellow
YB—Yellow and Black
YG—Yellow and Green
YR—Yellow and Red
BLY—Blue and Yellow
BLR—Blue and Red
RY—Red and Yellow

4	Pins 7 and 9 (1/2 of 5V rail)	V dc	2.5	2.5	
5	Pins 2 and 14 (1/2 of 5V rail)	V dc	2.5	2.5	
6	Pin 8 (gnd - /QSD EN, installed in Power Supply Stage)	V dc	0	0	
7	Pin 16 (5 V rail)	V dc	5	5	

Go to Top of Page

Quadrature Sampling Detector - (Optional) QSD Output Test

Power up the board and connect the USB cable

Run CFGSR.exe and dial in a desired center frequency

Inject an RF signal at approximately 10 kHz below the dialed in center frequency

Probe the hairpin leads of R30 and R31 with your dual channel scope

Depending upon your scope's sensitivity, you should see two 10 kHz signals in quadrature.

As you vary the injected signal to move it above the center frequency, you should see the quadrature signals change frequency and, at crossover, switch the leading and lagging positions.

Go to Top of Page

Test Steps (if any)

Go to Top of Page

Next Stage: Op Amps

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If line 5 (Taxable income) is —		And you are —		
At least	But less than	Single *or* Head of a household	Married filing jointly	Married filing separately
		Your tax is —		
83,000				
83,000	83,100	5,168	5,092	5,245
83,100	83,200	5,175	5,098	5,252
83,200	83,300	5,181	5,105	5,258
83,300	83,400	5,188	5,111	5,265
83,400	83,500	5,194	5,118	5,271
83,500	83,600	5,201	5,124	5,278
83,600	83,700	5,207	5,131	5,284
83,700	83,800	5,214	5,137	5,291
83,800	83,900	5,220	5,144	5,297
83,900	84,000	5,227	5,150	5,304
84,000				
84,000	84,100	5,233	5,157	5,310
84,100	84,200	5,240	5,163	5,317
84,200	84,300	5,246	5,170	5,323
84,300	84,400	5,253	5,176	5,330
84,400	84,500	5,259	5,183	5,336
84,500	84,600	5,266	5,189	5,343
84,600	84,700	5,272	5,196	5,349
84,700	84,800	5,279	5,202	5,356
84,800	84,900	5,285	5,209	5,362
84,900	85,000	5,292	5,215	5,369
85,000				
85,000	85,100	5,298	5,222	5,375
85,100	85,200	5,305	5,228	5,382
85,200	85,300	5,311	5,235	5,388
85,300	85,400	5,318	5,241	5,395
85,400	85,500	5,324	5,248	5,401
85,500	85,600	5,331	5,254	5,408
85,600	85,700	5,337	5,261	5,414
85,700	85,800	5,344	5,267	5,421
85,800	85,900	5,350	5,274	5,427
85,900	86,000	5,357	5,280	5,434
86,000				
86,000	86,100	5,363	5,287	5,440
86,100	86,200	5,370	5,293	5,447
86,200	86,300	5,376	5,300	5,453
86,300	86,400	5,383	5,306	5,460
86,400	86,500	5,389	5,313	5,466
86,500	86,600	5,396	5,319	5,473
86,600	86,700	5,402	5,326	5,479
86,700	86,800	5,409	5,332	5,486
86,800	86,900	5,415	5,339	5,492
86,900	87,000	5,422	5,345	5,499
87,000				
87,000	87,100	5,428	5,352	5,505
87,100	87,200	5,435	5,358	5,512
87,200	87,300	5,441	5,365	5,518
87,300	87,400	5,448	5,371	5,525
87,400	87,500	5,454	5,378	5,531
87,500	87,600	5,461	5,384	5,538
87,600	87,700	5,467	5,391	5,544
87,700	87,800	5,474	5,397	5,551
87,800	87,900	5,480	5,404	5,557
87,900	88,000	5,487	5,410	5,564
88,000				
88,000	88,100	5,493	5,417	5,570
88,100	88,200	5,500	5,423	5,577
88,200	88,300	5,506	5,430	5,583
88,300	88,400	5,513	5,436	5,590
88,400	88,500	5,519	5,443	5,596
88,500	88,600	5,526	5,449	5,603
88,600	88,700	5,532	5,456	5,609
88,700	88,800	5,539	5,462	5,616
88,800	88,900	5,545	5,469	5,622
88,900	89,000	5,552	5,475	5,629
89,000				
89,000	89,100	5,558	5,482	5,635
89,100	89,200	5,565	5,488	5,642
89,200	89,300	5,571	5,495	5,648
89,300	89,400	5,578	5,501	5,655
89,400	89,500	5,584	5,508	5,661
89,500	89,600	5,591	5,514	5,668
89,600	89,700	5,597	5,521	5,674
89,700	89,800	5,604	5,527	5,681
89,800	89,900	5,610	5,534	5,687
89,900	90,000	5,617	5,540	5,694
90,000				
90,000	90,100	5,623	5,547	5,700
90,100	90,200	5,630	5,553	5,707
90,200	90,300	5,636	5,560	5,713
90,300	90,400	5,643	5,566	5,720
90,400	90,500	5,649	5,573	5,726
90,500	90,600	5,656	5,579	5,733
90,600	90,700	5,662	5,586	5,739
90,700	90,800	5,669	5,592	5,746
90,800	90,900	5,675	5,599	5,752
90,900	91,000	5,682	5,605	5,759
91,000				
91,000	91,100	5,688	5,612	5,765
91,100	91,200	5,695	5,618	5,772
91,200	91,300	5,701	5,625	5,778
91,300	91,400	5,708	5,631	5,785
91,400	91,500	5,714	5,638	5,791
91,500	91,600	5,721	5,644	5,798
91,600	91,700	5,727	5,651	5,804
91,700	91,800	5,734	5,657	5,811
91,800	91,900	5,740	5,664	5,817
91,900	92,000	5,747	5,670	5,824
92,000				
92,000	92,100	5,753	5,677	5,830
92,100	92,200	5,760	5,683	5,837
92,200	92,300	5,766	5,690	5,843
92,300	92,400	5,773	5,696	5,850
92,400	92,500	5,779	5,703	5,856
92,500	92,600	5,786	5,709	5,863
92,600	92,700	5,792	5,716	5,869
92,700	92,800	5,799	5,722	5,876
92,800	92,900	5,805	5,729	5,882
92,900	93,000	5,812	5,735	5,889
93,000				
93,000	93,100	5,818	5,742	5,895
93,100	93,200	5,825	5,748	5,902
93,200	93,300	5,831	5,755	5,908
93,300	93,400	5,838	5,761	5,915
93,400	93,500	5,844	5,768	5,921
93,500	93,600	5,851	5,774	5,928
93,600	93,700	5,857	5,781	5,934
93,700	93,800	5,864	5,787	5,941
93,800	93,900	5,870	5,794	5,947
93,900	94,000	5,877	5,800	5,954
94,000				
94,000	94,100	5,883	5,807	5,960
94,100	94,200	5,890	5,813	5,967
94,200	94,300	5,896	5,820	5,973
94,300	94,400	5,903	5,826	5,980
94,400	94,500	5,909	5,833	5,986
94,500	94,600	5,916	5,839	5,993
94,600	94,700	5,922	5,846	5,999
94,700	94,800	5,929	5,852	6,006
94,800	94,900	5,935	5,859	6,012
94,900	95,000	5,942	5,865	6,019
95,000				
95,000	95,100	5,948	5,872	6,025
95,100	95,200	5,955	5,878	6,032
95,200	95,300	5,961	5,885	6,038
95,300	95,400	5,968	5,891	6,045
95,400	95,500	5,974	5,898	6,051
95,500	95,600	5,981	5,904	6,058
95,600	95,700	5,987	5,911	6,064
95,700	95,800	5,994	5,917	6,071
95,800	95,900	6,000	5,924	6,077
95,900	96,000	6,007	5,930	6,084
96,000				
96,000	96,100	6,013	5,937	6,090
96,100	96,200	6,020	5,943	6,097
96,200	96,300	6,026	5,950	6,103
96,300	96,400	6,033	5,956	6,110
96,400	96,500	6,039	5,963	6,116
96,500	96,600	6,046	5,969	6,123
96,600	96,700	6,052	5,976	6,129
96,700	96,800	6,059	5,982	6,136
96,800	96,900	6,065	5,989	6,142
96,900	97,000	6,072	5,995	6,149
97,000				
97,000	97,100	6,078	6,002	6,155
97,100	97,200	6,085	6,008	6,162
97,200	97,300	6,091	6,015	6,168
97,300	97,400	6,098	6,021	6,175
97,400	97,500	6,104	6,028	6,181
97,500	97,600	6,111	6,034	6,188
97,600	97,700	6,117	6,041	6,194
97,700	97,800	6,124	6,047	6,201
97,800	97,900	6,130	6,054	6,207
97,900	98,000	6,137	6,060	6,214
98,000				
98,000	98,100	6,143	6,067	6,220
98,100	98,200	6,150	6,073	6,227
98,200	98,300	6,156	6,080	6,233
98,300	98,400	6,163	6,086	6,240
98,400	98,500	6,169	6,093	6,246
98,500	98,600	6,176	6,099	6,253
98,600	98,700	6,182	6,106	6,259
98,700	98,800	6,189	6,112	6,266
98,800	98,900	6,195	6,119	6,272
98,900	99,000	6,202	6,125	6,279
99,000				
99,000	99,100	6,208	6,132	6,285
99,100	99,200	6,215	6,138	6,292
99,200	99,300	6,221	6,145	6,298
99,300	99,400	6,228	6,151	6,305
99,400	99,500	6,234	6,158	6,311
99,500	99,600	6,241	6,164	6,318
99,600	99,700	6,247	6,171	6,324
99,700	99,800	6,254	6,177	6,331
99,800	99,900	6,260	6,184	6,337
99,900	100,000	6,267	6,190	6,344

$100,000 or over –
use the
Tax Computation Worksheet
on page 16

WB5RVZ.Org - Ensemble HF/LF RX II Register Login

Home Bands Power Supply USB Power LO Dividers BPFs QSD

Op Amps BOM BOM X-Ref Inventory Revisions as of 6/20/2013 WB5RVZ

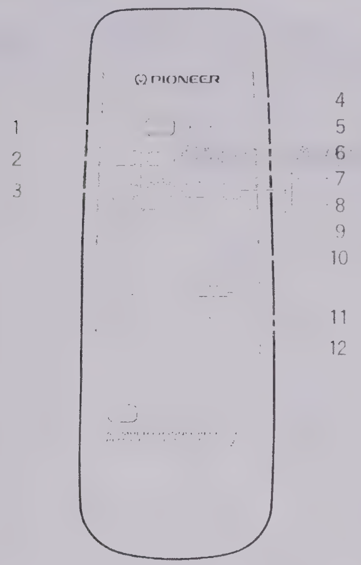
Ensemble RX II (HF/LF) Operational Amplifiers
Band: LF

Introduction

General Info About the Stage

Theory of Operation

Stage Schematic



◀◀

Continuously pressing this button will start fast rewind playback.

Stops playback

▶▶

Pressing this button continuously will start fast forward playback

■

Stops playback.

▶

Starts playback.

11, 12 **CD DISC –, +**

Use to select the disc for CD players which can play several discs.

CASSETTE DECK operation

Press the TAPE button in the SOURCE SELECT area, and operate as desired using the following buttons.

1 ⏻ **(power) STANDBY/ON**

Use to turn STANDBY ON the cassette deck

(Cannot turn STANDBY ON some cassette decks.)

◀

Plays in the direction of the arrow.

II

Pauses playback and recording

6 ◀◀

Rewinds the tape. Pressing this button during playback will start fast rewind playback.

7 ▶▶

Fast forwards the tape. Pressing this button during playback will start fast forward playback.

8 ■

Stops tape running.

9 ▶

Plays in the direction of the arrow

memo

- When operating a double cassette deck, the deck II must be operated
- For double cassette decks, the Number buttons can be used to operate deck 1 also.
  (Some models cannot be operated.)

10 ▭ **(◀)**

Plays in the direction of the arrow

(◀◀)

Fast rewinds the tape in the direction of the arrow.

(▶▶)

Fast forwards the tape in the direction of the arrow.

(II)

Pauses playback.

11 ▭ **(▶)**

Plays in the direction of the arrow.

12 ▭ **(■)**

Stops tape running.

TV operation

Press the TV CONTROL button in the SOURCE SELECT area, and operate as desired using the following buttons.

1 ⏻ **(power) STANDBY/ON**

Use to turn STANDBY ON the TV

2 **TV FUNC.**

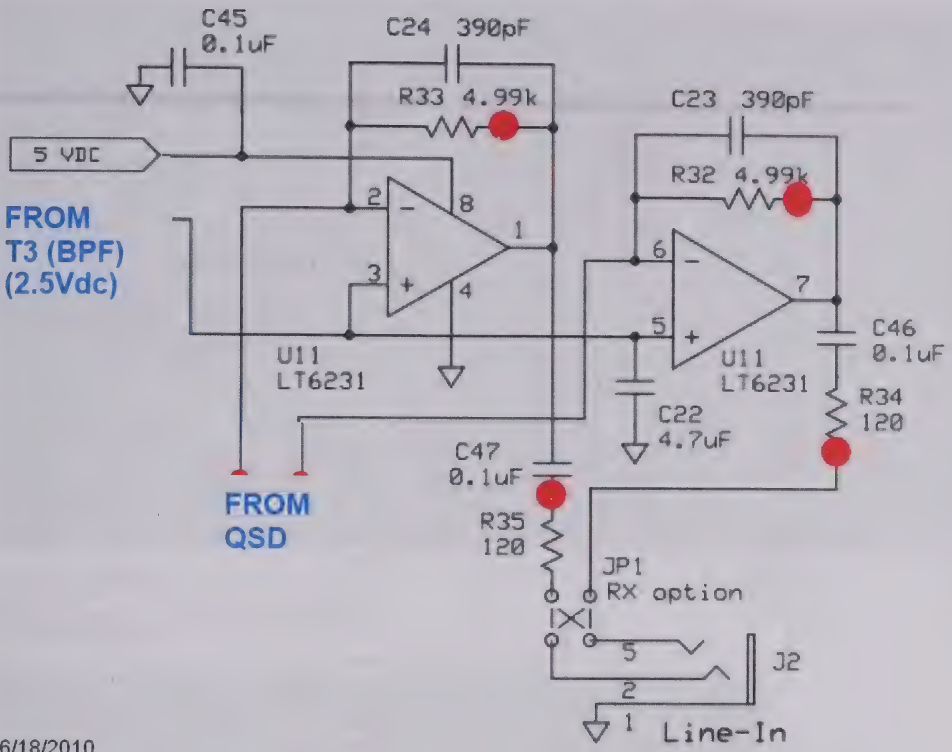
Use to select the TV input

4, 5 **CHANNEL –, +**

Use to select a TV broadcast channel

6, 7 **TV VOL. –, +**

Use to adjust the TV volume



6/18/2010

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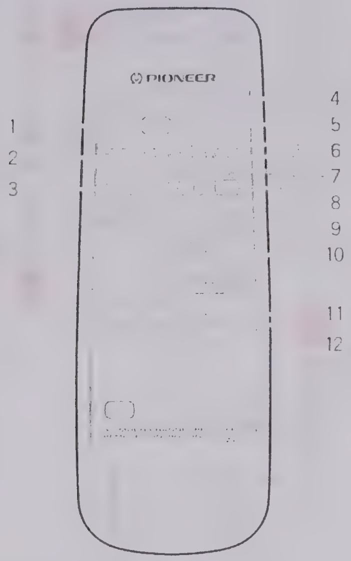
Click here for full schematic

(Red dots represent the "hairpin" (or left-hand or topmost) lead of the component)

Board Layouts

Board Top



DVD PLAYER operation

Press the DVD button in the SOURCE SELECT area, and operate as desired using the following buttons.

(power) STANDBY/ON
Use to turn STANDBY ON the DVD player

II
Use to pause. (In some players, pressing this button may set still pictures.)

4 **|◀◀**
Pressing and releasing this button immediately returns playback to the beginning of the chapter (track) currently being played. Pressing it continuously returns playback to the beginning of a previous chapter (track).

5 **▶▶|**
Pressing and releasing this button immediately advances playback to the beginning of the next chapter (track). Pressing it continuously advances playback to the beginning of a future chapter (track)

◀◀
Continuously pressing this button will start fast rewind playback.

▶▶
Continuously pressing this button will start fast forward playback

8 **■**
Pressing this button during playback will stop the unit.

9 **▶**
Starts playback.

LD PLAYER operation

Press the LD button in the SOURCE SELECT area, and operate as desired using the following buttons.

1 **(power) STANDBY/ON**
Use to turn STANDBY ON the LD player.

II
Use to pause. (In some players, pressing this button may set still pictures.)

4 **|◀◀**
Pressing and releasing this button immediately returns playback to the beginning of the chapter (track) currently being played. Pressing it continuously returns playback to the beginning of a previous chapter (track)

▶▶|
Pressing and releasing this button immediately advances playback to the beginning of the next chapter (track). Pressing it continuously advances playback to the beginning of a future chapter (track).

◀◀
Continuously pressing this button will start fast rewind playback

▶▶
Continuously pressing this button will start fast forward playback.

■
Pressing this button during playback will stop the unit. (With some LD players, the disc table may come out if pressed during stop.)

▶
Starts playback

11 **CD DISC + (SIDE A/B)**
Switches between side A and B of the disc.

CD PLAYER operation

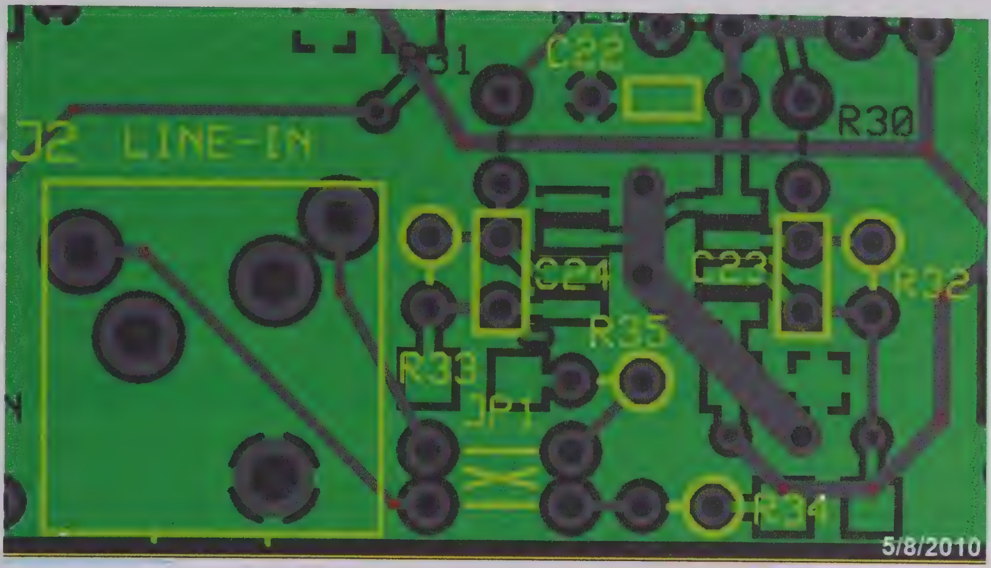
Press the CD button in the SOURCE SELECT area, and operate as desired using the following buttons.

1 **(power) STANDBY/ON**
Use to turn STANDBY ON the CD player

II
Use to pause playback.

4 **|◀◀**
Pressing and releasing this button immediately returns playback to the beginning of the track currently being played. Pressing it continuously returns playback to the beginning of a previous track

5 **▶▶|**
Pressing and releasing this button immediately advances playback to the beginning of the next track. Pressing it continuously advances playback to the beginning of a future track



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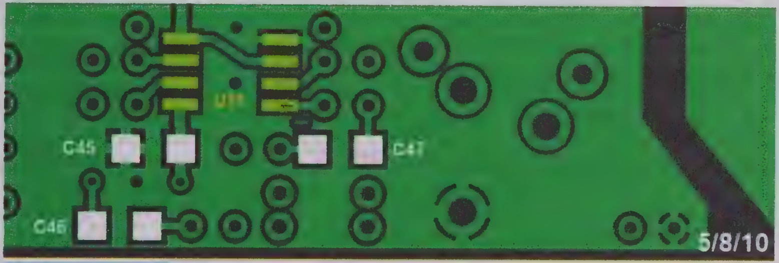
Board Bottom



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Summary Build Notes

1. Install Bottomside Parts
2. Install Topside Parts
3. Test the Stage

Operational Amplifiers Bill of Materials (LF band option)

Check	Type	Category	Component	Count	Marking	Image

From: <webform@paypal.com>
Subject: **Re: BankAccount/CreditCard (Routing Code: C840-L001-T11006-S111-W000000) (KMM131479231I96L0KM) :ppk1**
Date: July 4, 2009 2:11:03 PM CDT
To: "James Beyer" <beyer@engr.wisc.edu>

Dear James Beyer,

Thank you for contacting PayPal.

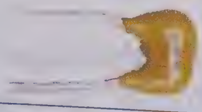
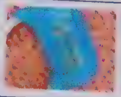
Hello my name is Krizna April; I understand that you want to update your card information. I am happy to assist you with your questions.

Regarding your concern, since you do have new card with new card #, you just need to add that card in your PayPal accounting and remove the old one.

You can add a debit or credit card to your PayPal account from your profile. Here's how:

1. Go to the PayPal website and log in to your account.
2. Click "Profile" at the top of the page.
3. Click "Credit/Debit Cards" under Financial Information.
4. Click "Add a Card" if you already have a card registered.
5. Enter your information and click "Add Card."

Please note that a debit or credit card can be registered to only

☐	Capacitor	Ceramic	390 pF 5%	2	391	
☐	Capacitor	SMT 1206	0.1 uF	3	(smt) black stripe	
☐	Capacitor	Ceramic	4.7 uF 10% 16V X7R RAD	1	475	
☐	connector	Jack-RA	3.5mm stereo jack - PCB mount (rt-angle)	1		
☐	IC	SOIC-8	LT6231 dual op-amp	1	LT6231 ESD!!!	
☐	Resistor	1/6W	120 1/6W 5%	2	brn-red-brn-gld	
☐	Resistor	1/4W	4.99 k 1/4W 1%	2	y-w-w-br-br	
☐	wire	Cutoff	shunt wire (cut-off lead)	2		

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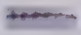
Detailed Build Steps

Install Bottomside Parts

Install Bottomside Parts

Check	Designation	Component (top/bottom)	Orientation	Marking	Image	Band	Notes
☐	U11	LT6231 dual op-amp ((bottom))	(or LT6221)	LT6231 ESD!!!		any	
☐	C45	0.1 uF ((bottom))	white pads	(smt) black stripe		any	

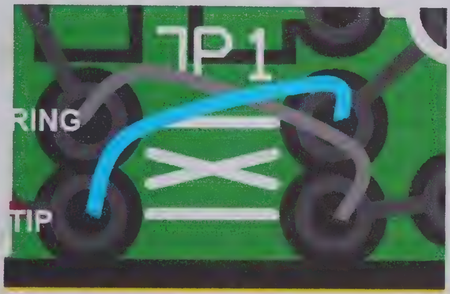
Form Message
customer subject: my card number has been changed
customer message: Last # digits of your credit card/debit card: '####'
Additional Information: 'I need to replace my old card number with a
new one. My old number has been cancelled,'

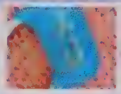
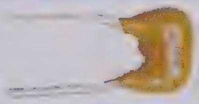
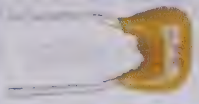
☐	C46	0.1 uF ((bottom))	white pads	(smt) black stripe		any	
☐	C47	0.1 uF ((bottom))	white pads	(smt) black stripe		any	

Install Topside Parts

Careful - there are 1/6W and 1/4W resistors in this step.

When installing the jumpers to the line-in jack, the builder is advised to install them crosswise (i.e., in the "X" pattern), rather than straight (in the parallel pattern), using insulated hookup wire to avoid shorts. This will make the receiver adaptable to all currently published SDR software. While the outputs would appear reversed to Rocky and Winrad, those two programs have a programmatic "switch I and Q lines" setting that can compensate. The PSDR versions do not have such a setting.



Check	Designation	Component (top/bottom)	Orientation	Marking	Image	Band
☑	C22	4.7 uF 10% 16V X7R RAD (top)	horiz	475		any
☑	C24	390 pF 5% (top)	vert	391		any
☑	C23	390 pF 5% (top)	vert	391		any
☑	R32	4.99 k 1/4W 1% (top)	N-S	y-w-w-br-br		any

one PayPal account.

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2. Click "Profile" at the top of the page.
3. Click the "Credit Cards" link in the Financial Information column.
4. Click "Remove" in the Action column of the card to be removed.
5. Click "Remove" again.

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Thanks for sharing your concerns with us. We value what you have to say, and we know situations like this can be difficult. If you have more questions, visit our Help Center by clicking "Help" in the top right corner of any PayPal page.

Sincerely,
Krizna April
Consumer Support
PayPal, an eBay Company

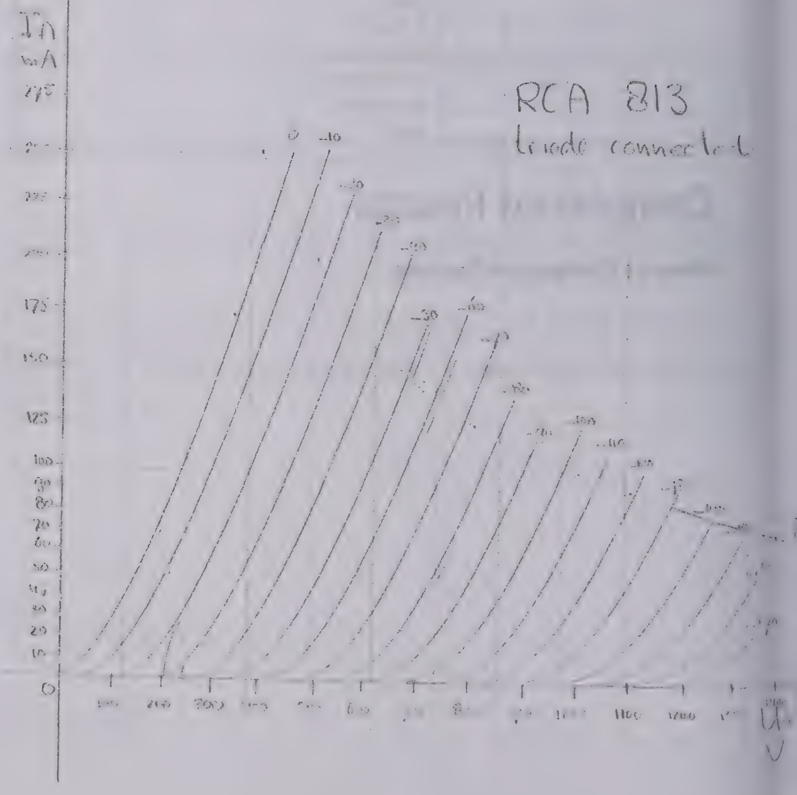
Original Message Follows:

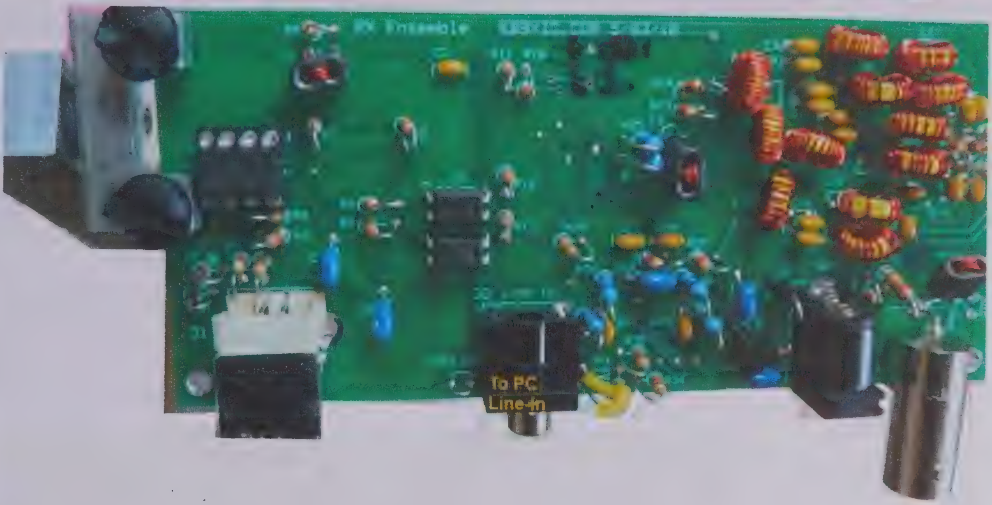
☑	R33	4.99 k 1/4W 1% (top)	N-S	y-w-w-br-br		any
☑	R34	120 1/6W 5% (top)	E-W	brn-red-brn-gld		any
☑	R35	120 1/6W 5% (top)	E-W	brn-red-brn-gld		any
☐	JP1A	shunt wire (cut-off lead) (top)				any
☐	JP1B	shunt wire (cut-off lead) (top)				any
☐	J02	3.5mm stereo jack - PCB mount (rt-angle) (top)				any

Completed Photos

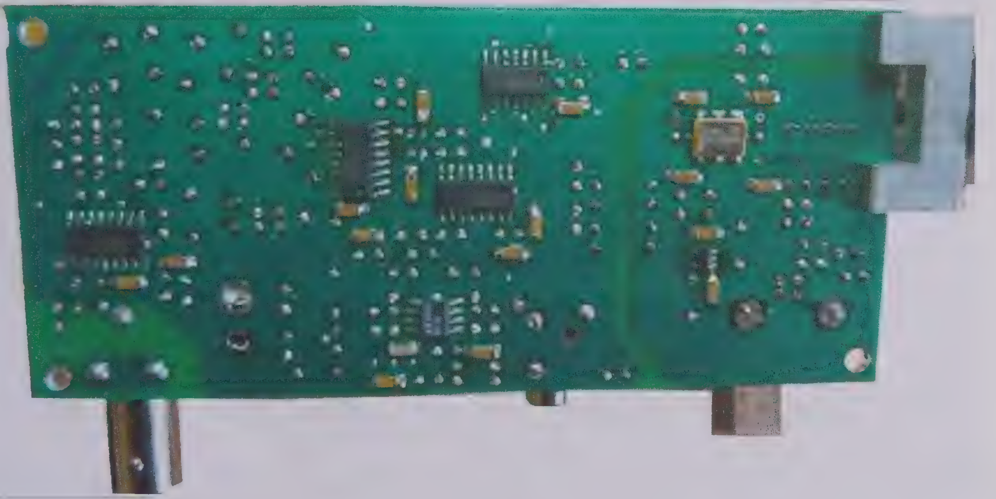
View of Completed Topside

813 curves.gif (GIF Image, 2550x3510 pixels) - Scaled (15%)





View of Completed Underside



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Test the Operational Amplifiers Stage

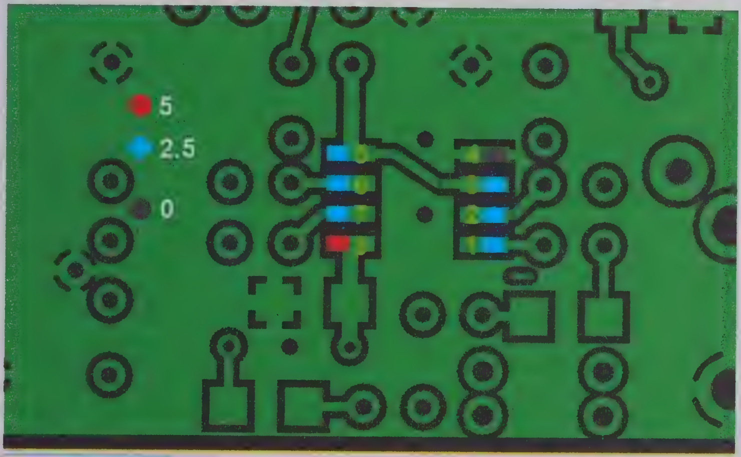
Operational Amplifiers - Pin

Voltage Tests

Test pin voltages WRT regular ground, as per graphic

As usual, if you are having any problems with this stage, be sure to measure the pin voltages two ways: first, measure each pin at the pin itself (on the IC). Then take a second measurement at the pin pad (on the board). If those two measurements do NOT agree, you very likely have a soldering issue.

If you are measuring zero volts where expected value is 2.5V, check the voltage at R28 hairpin again (this was checked in the Auto Bandpass Filter stage and should have been ~2.5 Vdc in that check. If it is now zero, check for shorts. Also check for the correct values in R32 and R33. If these were accidentally installed as 49.9 ohms vs 4.99K ohms, the voltage at R28 hairpin could approximate zero .



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Test Steps (if any)

Step	Test Point	UOM	Nominal	Author's	Builder's
1	Pin 1 (50% of 5V rail)	V dc	2.5	2.45	
2	Pin 2 (50% of 5V rail)	V dc	2.5	2.43	
3	Pin 3 (50% of 5V rail)	V dc	2.5	2.43	
4	Pin 4 (gnd)	V dc	0	0	
5	Pin 5 (50% of 5V rail)	V dc	2.5	2.43	
6	Pin 6 (50% of 5V rail)	V dc	2.5	2.43	
7	Pin 7 (50% of 5V rail)	V dc	2.5	2.46	

8	Pin 8 (5V rail)	V dc	5	4.92	

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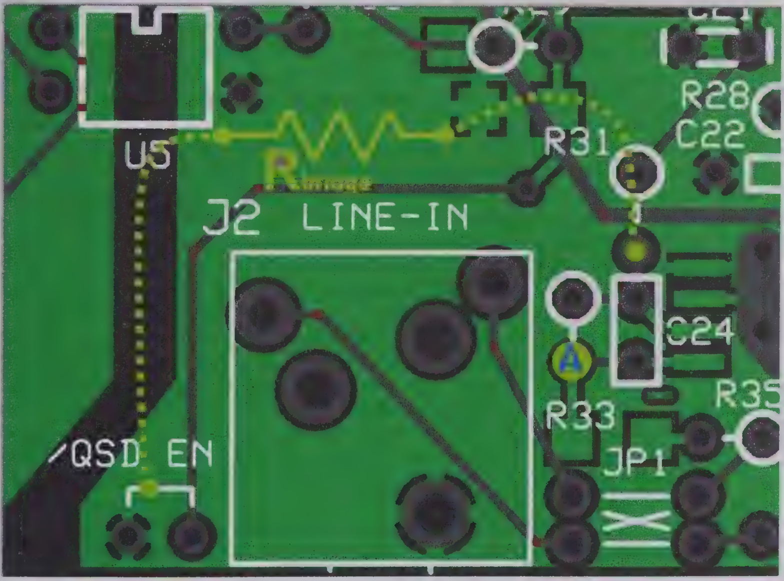
Operational Amplifiers - Functional Test

Test Setup

For this test, you will need to obtain a 10k resistor from your junk box or other source for this test. It is not furnished with the kit

In this test, you will test the DC gain of each of the op-amps by temporarily connecting a bridging resistor R_b (10k Ohm) from each op-amp inverting input to circuit regular ground. Introducing the "bridging" resistor R_b will result in a test current equal to 2.5 / R_t, which will be balanced by the current fed back from each op-amp's output through each feedback resistor, R_f (i.e., R33 or R32). Each op-amp output will increase in voltage by $2.5 * R_f / R_b$ from the nominal DC level of 2.5 volts.

Test the First OpAmp



1. Power up the circuit and measure the voltage at pin 1 of the op-amp (hairpin of R33). It should be ~2.5 Vdc
2. Power off and use clip leads to connect R_b between the hairpin of R31 and circuit ground.

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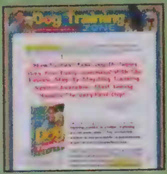
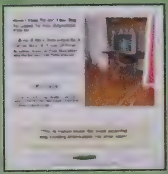


Dog Training Zone

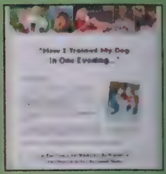
Dog

Number 3



DogProblems.com

Number 4



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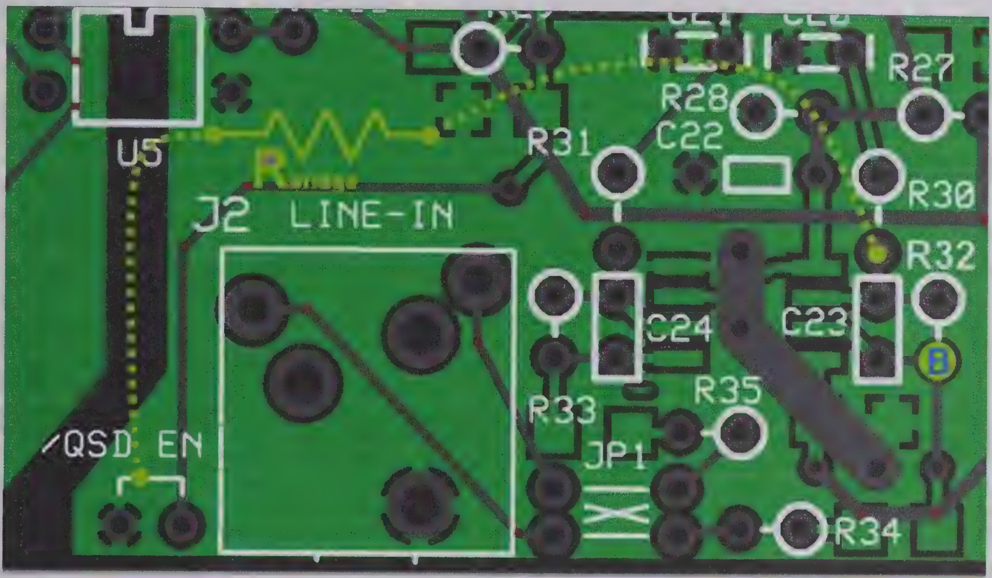
This provides an input resistance(R_i) of 10 kΩ, to the op-amp.

3. Power up and measure the output voltage (WRT regular ground) at the hairpin of the feedback resistor R33. You should get ~3.75 Vdc at R33 hairpin.
4. Remove R_b and the output voltage at R33 should go back to ~2.5 Vdc.

Test the Second OpAmp



1. Power up the circuit and measure the voltage at pin 1 of the op-amp (hairpin of R32). It should be ~2.5 Vdc
2. Power off and use clip leads to connect R_b between the hairpin of R30 and circuit ground. This provides an input resistance(R_i) 10 kΩ, to the op-amp.
3. Power up and measure the output voltage (WRT regular ground) at the hairpin of the feedback resistor R32. You should get: ~3.75 Vdc at R32 hairpin.
4. Remove R_b and the output voltage at R32 should go back to ~2.5 Vdc.

The diagram above show the test points. The yellow dots show the R_b connection points for each "side" of the opamps. The dots marked "A" and "B" show the measurement points for the output voltages for Each "side" of the OpAmps.

An Excel spreadsheet with a calculator for this test is available for you to plug in your bridging resistor ohms (R_t) and your pin 1 or pin 7 normal voltages (E_{bias}) and predict the expected voltage when bridged (E_{out}).

If your results are not as nominally expected, double check the values of R32 and R33 (both 4.99k, NOT 49.9). See this message thread on the Yahoo Softrock40 reflector.

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Test Steps (if any)

From: Jessica_Olejniczak@ssmhc.com
Subject: **Perspectives on Parkinson's Disease Program**
Date: December 1, 2009 12:26:20 PM CST
1 Attachment, 3.3 MB

Here is information on another webcast dealing with Parkinson's disease.

Jessica Olejniczak, Coordinator
APDA Information & Referral Center

St. Mary's Hospital
700 South Park Street
Madison, WI 53715
608/229-7628
parkinson_assn@ssmhc.com
www.wichapterapda.org

I GoodSearch & GoodShop for American Parkinson Disease Association - Wisconsin Chapter

Raise money for your favorite charity or school just by searching the Internet with GoodSearch.com (powered by Yahoo), or shopping on-line with GoodShop.com

I'm trying to get the word out about a free educational Parkinson's disease program supported by a grant from Teva Neuroscience, which is aimed at both medical professio and patients. The program consists of live teleconferences, which can be accessed via www.pdcast.net, which are given by leading professionals in the areas of Parkinson disease research. Here is our upcoming schedule, and you'll notice we have a teleconference this Wednesday evening:

Wednesday, December 2, 2009, 7:00 pm ET
Faculty Member: Robert Hauser, MD
Recent Findings on Treatment of Early Parkinson's Disease

Thursday, December 10, 2009, 7:00 pm ET
Faculty Member: Karl Kieburtz, MD
Disease Slowing in PD: How Will We Know It When We See It?

Thursday, December 17, 2009, 7:00 pm ET
Faculty Member: Lawrence Elmer, MD, PhD
Treatment of Early Parkinson's Disease

I was hoping that you may be able to help us spread the word by possibly sending an e-mail out to your chapter's mailing list about the program – on Wednesday Dr. Hauser will be covering the most recent findings concerning early treatment of PD – including the TEMPO and ADAGIO studies, and I know that a lot of people are interested in this research. The program is 100% free and it's a great resource for patients and physicians to ask questions to leading faculty that they otherwise would not have the opportun to get in contact with. This is our second round of teleconferences and we've gotten some great feedback from patients in the first round who are incredibly appreciative of getting access to the most recent research in PD.

I'd be more than happy to provide text for you to send out in an e-mail tomorrow, or you could distribute the attached PDF about the program

Step	Test Point	UOM	Nominal	Author's	Builder's
1	"A" (hairpin lead of R33 (NOT bridged)	V dc	2.5	2.45	
2	"A" (hairpin lead of R33 (bridged)	V dc	3.75	3.66	
3	"B" (hairpin lead of R32 (NOT bridged)	V dc	2.5	2.46	
4	"B" (hairpin lead of R32 (bridged)	V dc	3.75	3.68	

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Operational Amplifiers - RX Test

Prepare an SDR program for RX (author recommends Rocky for the Windows XP crowd; WinradHD for other Windows OS). This usually involves downloading and installing the program; selecting the desired soundcard for the (STEREO) input of the I and Q signals from the board; and connecting the board to the soundcard with a stereo cable with 1/8" stereo plugs on either end..

Once the SDR program is ready, connect the USB cable from your PC to the board, connect the 12V power to the board, and connect a 50 ohm antenna to J4.

Connect the "Line-In" jack on the pc board to the "Line-In" input jack on the pc or sound card, using a length of male-to-male stereo audio cable, with 18/" stereo plugs

Start the SDR program and adjust the LO frequency to the desired center frequency. You should see signals in the displayed spectrum. If there is a contest going on at test time, you will be even more impressed with the RX.!

Note: for either SDR program to work with the Ensemble RX, you MUST have installed the driver (libusb) for the Microcontroller's USB functionality. For WinradHD, you will also need to have downloaded and saved in the same directory as WinradHD, the EXTIO_Si570.dll file.

If you are seeing perfect mirror images of the signals either side of the center frequency, you should review the information in the Image Rejection Hints page.

> **If you installed the I/Q jumpers as suggested, you will need (in Rocky and/or Winrad) to switch the I and Q inputs to get signals properlay arrayed on the correct "side" of the center frequency.**

Note that there is an optional grounding via for the return side of the antenna connection. You do NOT want to connect this to the SDR ground per the advice in the webpage referenced below:).

Ground Loops and Humps

If you experience a large "hump" at the center frequency or several spurii on the spectrum, you may be the victim of ground loops.

Note to TreasuryDirect Account-Owners/Managers: Box 1 (Original Issue Discount for this tax year) is not applicable, and no amount ($0.00) is reported on this form.

Federal Income Tax Withheld (Ref. Box 4): Shows backup withholding. Generally, a payer must backup withhold at a 28% rate if you did not furnish your Taxpayer Identification Number (TIN) or you did not furnish the correct TIN to the payer. See IRS Form W-9, request for Taxpayer Identification Number and Certification, for information on backup withholding. Include this amount on your income tax return as tax withheld.

Return

Alan G4ZFQ has an excellent article on the effects of ground loops on the SDR and how to minimize/avoid them. (OK, Alan, so it's "minimise"!)

Another great resource from Alan is his page on "SDR with SoundCard Basic Faults" (which graphically shows what poor grounding can do in a sound-card-based SDR application).

Creative Soundcard (X-FI) Modification for SDR

One nice soundcard from Creative Systems, the Creative Soundblaster X-Fi Surround 5.1 Pro USB, has a great mod making it excellent for use in SDR applications. Check it out in this article.

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Test Steps (if any)

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PPLICATIONS INFORMATION

mplifier Characteristics

gure 1 is a simplified schematic of the LT6230/LT6231/T6232, which has a pair of low noise input transistors Q1 nd Q2. A simple current mirror Q3/Q4 converts the fferential signal to a single-ended output, and these ansistors are degenerated to reduce their contribution to e overall noise.

apacitor C1 reduces the unity cross frequency and nproves the frequency stability without degrading the ain bandwidth of the amplifier. Capacitor C_M sets the verall amplifier gain bandwidth. The differential drive enerator supplies current to transistors Q5 and Q6 that wing the output from rail-to-rail.

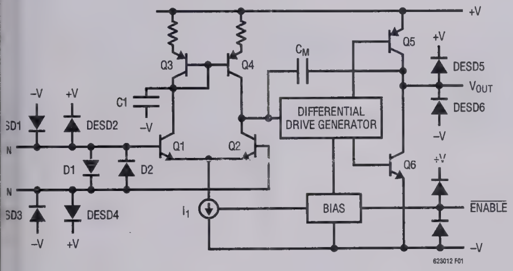


Figure 1. Simplified Schematic

put Protection

here are back-to-back diodes, D1 and D2 across the + and inputs of these amplifiers to limit the differential input oltage to ±0.7V. The inputs of the LT6230/LT6231/T6232 do not have internal resistors in series with the put transistors. This technique is often used to protect e input devices from over voltage that causes excessive urrent to flow. The addition of these resistors would ignificantly degrade the low noise voltage of these ampliers. For instance, a 100Ω resistor in series with each put would generate 1.8nV/$\sqrt{\text{Hz}}$ of noise, and the total mplifier noise voltage would rise from 1.1nV/$\sqrt{\text{Hz}}$ to .1nV/$\sqrt{\text{Hz}}$. Once the input differential voltage exceeds 0.7V, steady state current conducted through the protecon diodes should be limited to ±40mA. This implies 25Ω f protection resistance is necessary per volt of overdrive eyond ±0.7V. These input diodes are rugged enough to handle transient currents due to amplifier slew rate overdrive and clipping without protection resistors.

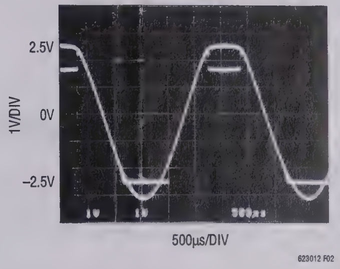


Figure 2. V_S = ±2.5V, A_V = 1 with Large Overdrive

The photo of Figure 2 shows the output response to an input overdrive with the amplifier connected as a voltage follower. With the input signal low, current source I_1 saturates and the differential drive generator drives Q6 into saturation so the output voltage swings all the way to $V^–$. The input can swing positive until transistor Q2 saturates into current mirror Q3/Q4. When saturation occurs, the output tries to phase invert, but diode D2 conducts current from the signal source to the output through the feedback connection. The output is clamped a diode drop below the input. In this photo, the input signal generator is limiting at about 20mA.

With the amplifier connected in a gain of $A_V \geq 2$, the output can invert with very heavy overdrive. To avoid this inversion, limit the input overdrive to 0.5V beyond the power supply rails.

ESD

The LT6230/LT6231/LT6232 have reverse-biased ESD protection diodes on all inputs and outputs as shown in Figure 1. If these pins are forced beyond either supply, unlimited current will flow through these diodes. If the current is transient and limited to one hundred milliamps or less, no damage to the device will occur.

Noise

The noise voltage of the LT6230/LT6231/LT6232 is equivalent to that of a 75Ω resistor, and for the lowest possible noise it is desirable to keep the source and feedback resistance at or below this value, i.e. $R_S + R_G || R_{FB} \leq 75Ω$.

FAIRCHILD
SEMICONDUCTOR TM

September 1997
Revised December 1999

FST3253
Dual 4:1 Multiplexer/Demultiplexer Bus Switch

General Description

The Fairchild Switch FST3253 is a dual 4:1 high-speed CMOS TTL-compatible multiplexer/demultiplexer bus switch. The low on resistance of the switch allows inputs to be connected to outputs without adding propagation delay or generating additional ground bounce noise.

When $\overline{OE}$ is LOW, S_0 and S_1 connect the A Port to the selected B Port output. When $\overline{OE}$ is HIGH, the switch is OPEN and a high-impedance state exists between the two ports.

Features

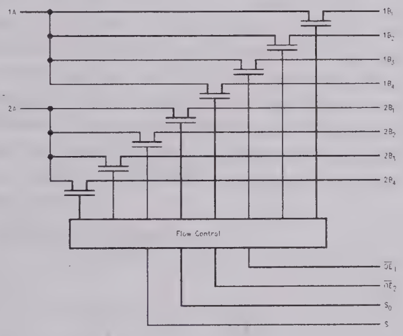
- 4Ω switch connection between two ports.
- Minimal propagation delay through the switch.
- Low I_{CC}.
- Zero bounce in flow-through mode.
- Control inputs compatible with TTL level.

Ordering Code:

Order Number	Package Number	Package Description
FST3253M	M16A	16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150 Narrow
FST3253QSC	MQA16	16-Lead Quarter Size Outline Package (QSOP), JEDEC MO-137, 0.150 Wide
FST3253MTC	MTC16	16-Lead Thin Shrink Small Outline Package (TSSOP), JEDEC MO-153, 4.4mm Wide

Device also available in Tape and Reel. Specify by appending suffix letter "X" to the ordering code.

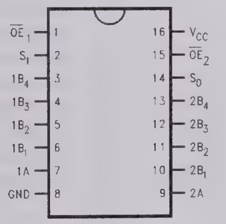
Logic Diagram



Pin Descriptions

Pin Name	Description
$\overline{OE}_1$, $\overline{OE}_2$	Bus Switch Enables
S_0, S_1	Select Inputs
A	Bus A
B_1, B_2, B_3, B_4	Bus B

Connection Diagram



Truth Table

S_1	S_0	$\overline{OE}_1$	$\overline{OE}_2$	Function
X	X	H	X	Disconnect 1A
X	X	X	H	Disconnect 2A
L	L	L	L	$A = B_1$
L	H	L	L	$A = B_2$
H	L	L	L	$A = B_3$
H	H	L	L	$A = B_4$

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$$\frac{1.8x}{1.8+x} = 1.6$$

$$1.8x = 1.6(1.8) + 1.6x$$

$$.2x = 1.6(1.8)$$

$$x = \cancel{14}\ 14.4k$$

	V	I	
1.6k	0.5	0.3 mA	
1.6	1.0	0.6	
1.57	1.5	0.95	
1.3	2.0	1.5	
0.32	2.5	7.6	
0.26 Jump	3.0	11.2	
		16.1	
	3.5	20	time rise
0.21	4.0	25	
0.2	4.5	37	
0.18	5.0		
.13			

SILICON LABS

Si570/Si571

ANY-RATE I²C PROGRAMMABLE XO/VCXO

Features

- Any-rate programmable output frequencies from 10 to 945 MHz and select frequencies to 1.4 GHz
- I²C serial interface
- 3rd generation DSPLL® with superior jitter performance
- 3x better frequency stability than SAW-based oscillators
- Internal fixed crystal frequency ensures high reliability and low aging
- Available LVPECL, CMOS, LVDS, and CML outputs
- Industry-standard 5x7 mm package
- Pb-free/RoHS-compliant
- 1.8, 2.5, or 3.3 V supply

Ordering Information:
See page 24.

Applications

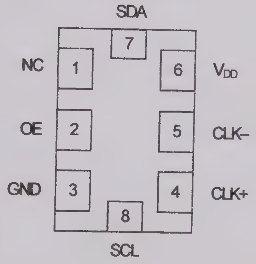
- SONET / SDH
- xDSL
- 10 GbE LAN / WAN
- Low-jitter clock generation
- Optical modules
- Clock and data recovery

Description

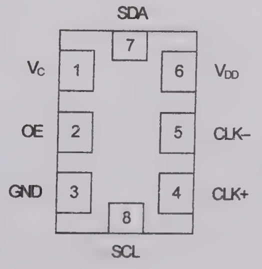
The Si570 XO/Si571 VCXO utilizes Silicon Laboratories' advanced DSPLL® circuitry to provide a low-jitter clock at any frequency. The Si570/Si571 are user-programmable to any output frequency from 10 to 945 MHz and select requencies to 1400 MHz with <1 ppb resolution. The device is programmed via an I²C serial interface. Unlike traditional XO/VCXOs where a different crystal is required for each output frequency, the Si57x uses one fixed-requency crystal and a DSPLL clock synthesis IC to provide any-rate requency operation. This IC-based approach allows the crystal resonator to provide exceptional frequency stability and reliability. In addition, DSPLL clock synthesis provides superior supply noise rejection, simplifying the task of generating low-jitter clocks in noisy environments typically found in ommunication systems.

Pin Assignments:
See page 23.

(Top View)

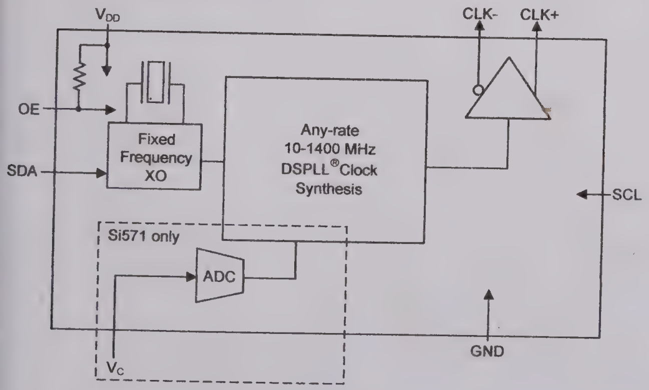


Si570



Si571

Functional Block Diagram



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1. Detailed Block Diagrams

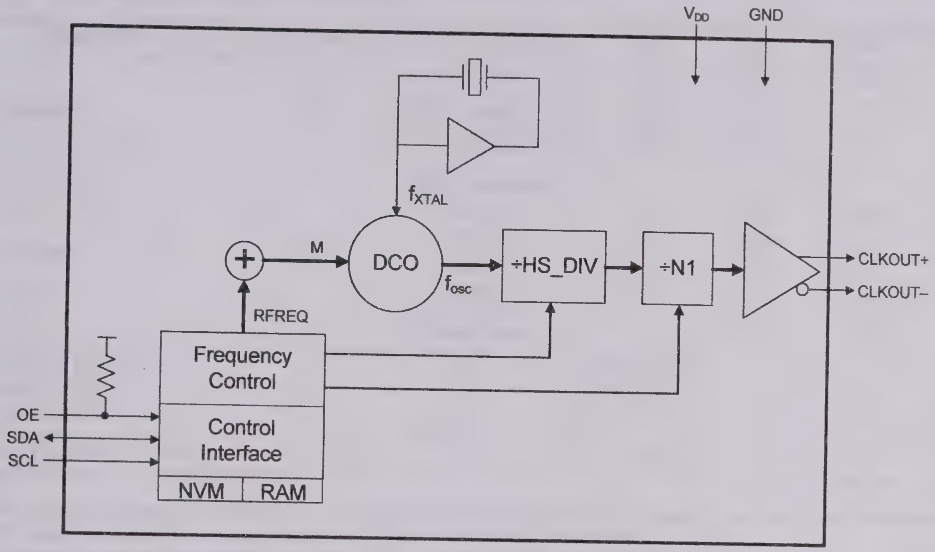


Figure 1. Si570 Detailed Block Diagram

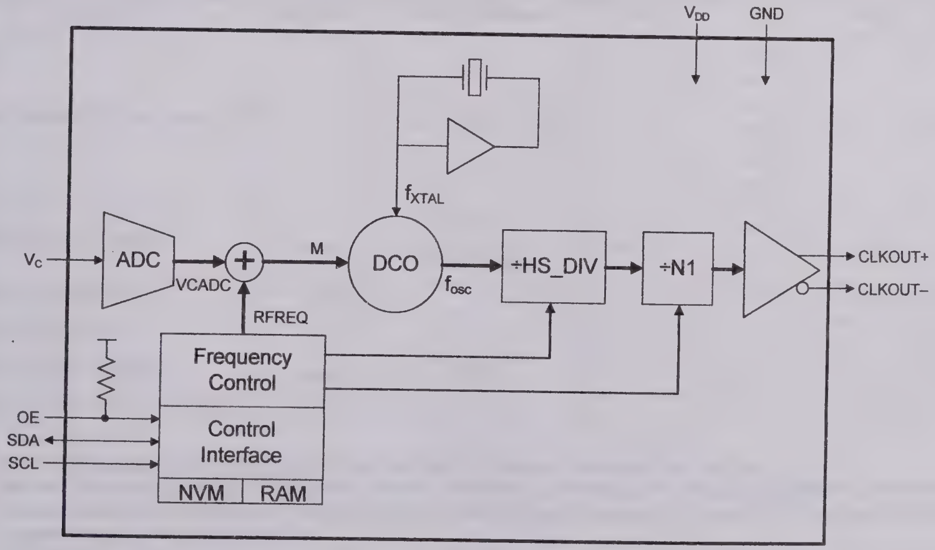


Figure 2. Si571 Detailed Block Diagram

2. Electrical Specifications

Table 1. Recommended Operating Conditions

Parameter	Symbol	Test Condition	Min	Typ	Max	Units
Supply Voltage[1]	V_{DD}	3.3 V option	2.97	3.3	3.63	V
		2.5 V option	2.25	2.5	2.75	
		1.8 V option	1.71	1.8	1.89	
Supply Current	I_{DD}	Output enabled				mA
		LVPECL	—	120	130	
		CML	—	108	117	
		LVDS	—	99	108	
		CMOS	—	90	98	
		TriState mode	—	60	75	
Output Enable (OE)[2], Serial Data (SDA), Serial Clock (SCL)		V_{IH}	0.75 x V_{DD}	—	—	V
		V_{IL}	—	—	0.5	
Operating Temperature Range	T_A		–40	—	85	°C

Notes:

1. Selectable parameter specified by part number. See Section "7. Ordering Information" on page 24 for further details.
2. OE pin includes a 17 kΩ pullup resistor to V_{DD}. See "7.Ordering Information".

Table 2. V_C Control Voltage Input

Parameter	Symbol	Test Condition	Min	Typ	Max	Units
Control Voltage Tuning Slope[1,2,3]	K_V	V_C 10 to 90% of V_{DD}	—	33 45 90 135 180 356	—	ppm/V
Control Voltage Linearity[4]	L_{VC}	BSL	–5	±1	+5	%
		Incremental	–10	±5	+10	
Modulation Bandwidth	BW		9.3	10.0	10.7	kHz
V_C Input Impedance	Z_{VC}		500	—	—	kΩ
Nominal Control Voltage	V_{CNOM}	@ f_O	—	$V_{DD}/2$	—	V
Control Voltage Tuning Range	V_C		0		V_{DD}	V

Notes:

1. Positive slope; selectable option by part number. See "7. Ordering Information" on page 24.
2. For best jitter and phase noise performance, always choose the smallest K_V that meets the application's minimum APR requirements. See "AN266: VCXO Tuning Slope (K_V), Stability, and Absolute Pull Range (APR)" for more information.
3. K_V variation is ±10% of typical values.
4. BSL determined from deviation from best straight line fit with V_C ranging from 10 to 90% of V_{DD}. Incremental slope is determined with V_C ranging from 10 to 90% of V_{DD}.

Table 3. CLK± Output Frequency Characteristics

Parameter	Symbol	Test Condition	Min	Typ	Max	Units
Programmable Frequency Range^{1,2,3}	f_O	LVPECL/LVDS/CML	10	—	1417.5	MHz
		CMOS	10	—	160	
Temperature Stability^{1,4}		T_A = –40 to +85 °C	–20 –50 –100	— — —	+20 +50 +100	ppm
Initial Accuracy			—	1.5	—	ppm
Aging	f_a	Frequency drift over first year	—	—	±3	ppm
		Frequency drift over 15 year life	—	—	±10	ppm
Total Stability		Temp stability = ±20 ppm	—	—	±31.5	ppm
		Temp stability = ±50 ppm	—	—	±61.5	ppm
Absolute Pull Range^{1,4}	APR		±25	—	±375	ppm
Power up Time^{5}	t_{OSC}		—	—	10	ms

Notes:

1. See Section "7. Ordering Information" on page 24 for further details.
2. Specified at time of order by part number. Three speed grades available:
   Grade A covers 10 to 945 MHz, 970 to 1134 MHz, and 1213 to 1417.5 MHz.
   Grade B covers 10 to 810 MHz.
   Grade C covers 10 to 280 MHz.
3. Nominal output frequency set by $V_{CNOM} = 1/2 \times V_{DD}$.
4. Selectable parameter specified by part number.
5. Time from power up or tristate mode to f_O.

Table 4. CLK± Output Levels and Symmetry

Parameter	Symbol	Test Condition	Min	Typ	Max	Units
LVPECL Output Option[1]	V_O	mid-level	$V_{DD} - 1.42$	—	$V_{DD} - 1.25$	V
	V_{OD}	swing (diff)	1.1	—	1.9	V_{PP}
	V_{SE}	swing (single-ended)	0.55	—	0.95	V_{PP}
LVDS Output Option[2]	V_O	mid-level	1.125	1.20	1.275	V
	V_{OD}	swing (diff)	0.5	0.7	0.9	V_{PP}
CML Output Option[2]	V_O	2.5/3.3 V option mid-level	—	$V_{DD} - 1.30$	—	V
		1.8 V option mid-level	—	$V_{DD} - 0.36$	—	V_{PP}
	V_{OD}	2.5/3.3 V option swing (diff)	1.10	1.50	1.90	V
		1.8 V option swing (diff)	0.35	0.425	0.50	V_{PP}
CMOS Output Option[3]	V_{OH}	I_{OH} = 32 mA	0.8 x V_{DD}	—	V_{DD}	V
	V_{OL}	I_{OL} = 32 mA	—	—	0.4	
Rise/Fall time (20/80%)	t_R, t_F	LVPECL/LVDS/CML	—	—	350	ps
		CMOS with C_L = 15 pF	—	1	—	ns
Symmetry (duty cycle)	SYM	LVPECL: $V_{DD} - 1.3$ V (diff) LVDS: 1.25 V (diff) CMOS: $V_{DD}/2$	45	—	55	%

Notes:

1. 50 Ω to $V_{DD} - 2.0$ V.
2. R_{term} = 100 Ω (differential).
3. C_L = 15 pF

Table 5. CLK± Output Phase Jitter (Si570)

Parameter	Symbol	Test Condition	Min	Typ	Max	Units
Phase Jitter (RMS)* for $F_{OUT} \geq$ 500 MHz	ϕ_J	12 kHz to 20 MHz (OC-48)	—	0.25	0.40	ps
		50 kHz to 80 MHz (OC-192)	—	0.26	0.37	
Phase Jitter (RMS)* for F_{OUT} of 125 to 500 MHz	ϕ_J	12 kHz to 20 MHz (OC-48)	—	0.36	0.50	ps
		50 kHz to 20 MHz (OC-192)	—	0.34	0.42	
Phase Jitter (RMS) for F_{OUT} of 10 to 160 MHz CMOS Output Only	ϕ_J	12 kHz to 20 MHz (OC-48)	—	0.62	—	ps
		50 kHz to 80 MHz (OC-192)	—	0.61	—	

Note: Refer to AN256 for further information.

Table 6. CLK± Output Phase Jitter (Si571)

Parameter	Symbol	Test Condition	Min	Typ	Max	Units
Phase Jitter (RMS)[1,2,3] for $F_{OUT} \geq 500$ MHz	ϕ_J	Kv = 33 ppm/V				ps
		12 kHz to 20 MHz (OC-48)	—	0.26	—	
		50 kHz to 80 MHz (OC-192)	—	0.26	—	
		Kv = 45 ppm/V				
		12 kHz to 20 MHz (OC-48)	—	0.27	—	
		50 kHz to 80 MHz (OC-192)	—	0.26	—	
		Kv = 90 ppm/V				
		12 kHz to 20 MHz (OC-48)	—	0.32	—	
		50 kHz to 80 MHz (OC-192)	—	0.26	—	
		Kv = 135 ppm/V				
		12 kHz to 20 MHz (OC-48)	—	0.40	—	
		50 kHz to 80 MHz (OC-192)	—	0.27	—	
		Kv = 180 ppm/V				
		12 kHz to 20 MHz (OC-48)	—	0.49	—	
		50 kHz to 80 MHz (OC-192)	—	0.28	—	
		Kv = 356 ppm/V				
		12 kHz to 20 MHz (OC-48)	—	0.87	—	
		50 kHz to 80 MHz (OC-192)	—	0.33	—	

Notes:

1. Differential Modes: LVPECL/LVDS/CML. Refer to AN255, AN256, and AN266 for further information.
2. For best jitter and phase noise performance, always choose the smallest K_V that meets the application's minimum APR requirements. See "AN266: VCXO Tuning Slope (K_V), Stability, and Absolute Pull Range (APR)" for more information.
3. See "AN255: Replacing 622 MHz VCSO devices with the Si550 VCXO" for comparison highlighting power supply rejection (PSR) advantage of Si55x versus SAW-based solutions.
4. Single ended mode: CMOS. Refer to the following application notes for further information:
   "AN255: Replacing 622 MHz VCSO Device with the Si55x VCXO"
   "AN256: Integrated Phase Noise"
   "AN266: VCXO Tuning Slope (Kv), Stability, and Absolute Pull Range (APR)"

Table 6. CLK± Output Phase Jitter (Si571) (Continued)

Parameter	Symbol	Test Condition	Min	Typ	Max	Units
Phase Jitter (RMS)^{2,4} for F_{OUT} 10 to 160 MHz CMOS Output Only	ϕ_J	Kv = 33 ppm/V				ps
		12 kHz to 20 MHz (OC-48)	—	0.63	—	
		50 kHz to 80 MHz (OC-192)	—	0.62	—	
		Kv = 45 ppm/V				
		12 kHz to 20 MHz (OC-48)	—	0.63	—	
		50 kHz to 80 MHz (OC-192)	—	0.62	—	
		Kv = 90 ppm/V				
		12 kHz to 20 MHz (OC-48)	—	0.67	—	
		50 kHz to 80 MHz (OC-192)	—	0.66	—	
		Kv = 135 ppm/V				
		12 kHz to 20 MHz (OC-48)	—	0.74	—	
		50 kHz to 80 MHz (OC-192)	—	0.72	—	
		Kv = 180 ppm/V				
		12 kHz to 20 MHz (OC-48)	—	0.83	—	
		50 kHz to 80 MHz (OC-192)	—	0.8	—	
		Kv = 356 ppm/V				
		12 kHz to 20 MHz (OC-48)	—	1.26	—	
		50 kHz to 80 MHz (OC-192)	—	1.2	—	

Notes:

1. Differential Modes: LVPECL/LVDS/CML. Refer to AN255, AN256, and AN266 for further information.
2. For best jitter and phase noise performance, always choose the smallest K_V that meets the application's minimum APR requirements. See "AN266: VCXO Tuning Slope (K_V), Stability, and Absolute Pull Range (APR)" for more information.
3. See "AN255: Replacing 622 MHz VCSO devices with the Si550 VCXO" for comparison highlighting power supply rejection (PSR) advantage of Si55x versus SAW-based solutions.
4. Single ended mode: CMOS. Refer to the following application notes for further information:
   "AN255: Replacing 622 MHz VCSO Device with the Si55x VCXO"
   "AN256: Integrated Phase Noise"
   "AN266: VCXO Tuning Slope (Kv), Stability, and Absolute Pull Range (APR)"

Table 6. CLK± Output Phase Jitter (Si571) (Continued)

Parameter	Symbol	Test Condition	Min	Typ	Max	Units
Phase Jitter (RMS)[1,2,3] for F_{OUT} of 125 to 500 MHz	ϕ_J	Kv = 33 ppm/V				ps
		12 kHz to 20 MHz (OC-48)	—	0.37	—	
		50 kHz to 80 MHz (OC-192)	—	0.33	—	
		Kv = 45 ppm/V				
		12 kHz to 20 MHz (OC-48)	—	0.37	—	
		50 kHz to 80 MHz (OC-192)	—	0.33	—	
		Kv = 90 ppm/V				
		12 kHz to 20 MHz (OC-48)	—	0.43	—	
		50 kHz to 80 MHz (OC-192)	—	0.34	—	
		Kv = 135 ppm/V				
		12 kHz to 20 MHz (OC-48)	—	0.50	—	
		50 kHz to 80 MHz (OC-192)	—	0.34	—	
		Kv = 180 ppm/V				
		12 kHz to 20 MHz (OC-48)	—	0.59	—	
		50 kHz to 80 MHz (OC-192)	—	0.35	—	
		Kv = 356 ppm/V				
		12 kHz to 20 MHz (OC-48)	—	1.00	—	
		50 kHz to 80 MHz (OC-192)	—	0.39	—	

Notes:

1. Differential Modes: LVPECL/LVDS/CML. Refer to AN255, AN256, and AN266 for further information.
2. For best jitter and phase noise performance, always choose the smallest K_V that meets the application's minimum APR requirements. See "AN266: VCXO Tuning Slope (K_V), Stability, and Absolute Pull Range (APR)" for more information.
3. See "AN255: Replacing 622 MHz VCSO devices with the Si550 VCXO" for comparison highlighting power supply rejection (PSR) advantage of Si55x versus SAW-based solutions.
4. Single ended mode: CMOS. Refer to the following application notes for further information:
   "AN255: Replacing 622 MHz VCSO Device with the Si55x VCXO"
   "AN256: Integrated Phase Noise"
   "AN266: VCXO Tuning Slope (Kv), Stability, and Absolute Pull Range (APR)"

Table 7. CLK± Output Period Jitter

Parameter	Symbol	Test Condition	Min	Typ	Max	Units
Period Jitter*	J_{PER}	RMS	—	2	—	ps
		Peak-to-Peak	—	14	—	

***Note:** Any output mode, including CMOS, LVPECL, LVDS, CML. N = 1000 cycles. Refer to "AN279: Estimating Period Jitter from Phase Noise" for further information.

Table 8. Typical CLK± Output Phase Noise (Si570)

Offset Frequency (f)	120.00 MHz LVDS	156.25 MHz LVPECL	622.08 MHz LVPECL	Units
100 Hz	–112	–105	–97	dBc/Hz
1 kHz	–122	–122	–107	
10 kHz	–132	–128	–116	
100 kHz	–137	–135	–121	
1 MHz	–144	–144	–134	
10 MHz	–150	–147	–146	
100 MHz	n/a	n/a	–148	

Table 9. Typical CLK± Output Phase Noise (Si571)

Offset Frequency (f)	74.25 MHz 90 ppm/V LVPECL	491.52 MHz 45 ppm/V LVPECL	622.08 MHz 135 ppm/V LVPECL	Units
100 Hz	–87	–75	–65	dBc/Hz
1 kHz	–114	–100	–90	
10 kHz	–132	–116	–109	
100 kHz	–142	–124	–121	
1 MHz	–148	–135	–134	
10 MHz	–150	–146	–146	
100 MHz	n/a	–147	–147	

Table 10. Absolute Maximum Ratings

Parameter	Symbol	Rating	Units
Supply Voltage, 1.8 V Option	V_{DD}	–0.5 to +1.9	V
Supply Voltage, 2.5/3.3 V Option	V_{DD}	–0.5 to +3.8	V
Input Voltage	V_I	–0.5 to V_{DD} + 0.3	V
Storage Temperature	T_S	–55 to +125	°C
ESD Sensitivity (HBM, per JESD22-A114)	ESD	>2500	V
Soldering Temperature (lead-free profile)	T_{PEAK}	260	°C
Soldering Temperature Time @ T_{PEAK} (lead-free profile)	t_P	20–40	seconds

Notes:

1. Stresses beyond the absolute maximum ratings may cause permanent damage to the device. Functional operation or specification compliance is not implied at these conditions.
2. The device is compliant with JEDEC J-STD-020C. Refer to Si5xx Packaging FAQ available for download at for further information, including soldering profiles.

Table 11. Environmental Compliance

The Si570/571 meets the following qualification test requirements.

Parameter	Conditions/Test Method
Mechanical Shock	MIL-STD-883F, Method 2002.3 B
Mechanical Vibration	MIL-STD-883F, Method 2007.3 A
Solderability	MIL-STD-883F, Method 203.8
Gross & Fine Leak	MIL-STD-883F, Method 1014.7
Resistance to Solvents	MIL-STD-883F, Method 2016

Table 12. Programming Constraints and Timing

(V_{DD} = 3.3 V ±10%, T_A = –40 to 85 °C)

Parameter	Symbol	Test Condition	Min	Typ	Max	Unit
Output Frequency Range	CKO_F	HS_DIV x N1 > = 6	10	—	945	MHz
		HS_DIV x N1 = 5 N1 = 1	970	—	1134	MHz
		HS_DIV = 4 N1 = 1	1.2125	—	1.4175	GHz
Frequency Reprogramming Resolution	M_{RES}	114.285 MHz	—	0.09	—	ppb
Internal Oscillator Frequency	f_{OSC}		4850	—	5670	MHz
Internal Crystal Frequency Accuracy	f_{XTAL}	Maximum variation is ±2000 ppm	—	114.285	—	MHz
Delta Frequency for Continuous Output		From center frequency	–3500	—	+3500	ppm
Unfreeze to NewFreq Delay					10	ms
Settling time for small frequency change		<±3500 ppm from center frequency	—	—	100	µs
Settling time for large frequency change		>±3500 ppm from center frequency after setting NewFreq bit	—	—	10	ms

3. Functional Description

The Si570 XO and the Si571 VCXO are low-jitter oscillators ideally suited for applications requiring programmable frequencies. The Si57x can be programmed to generate virtually any output clock in the range of 10 MHz to 1.4 GHz. Output jitter performance exceeds the strict requirements of high-speed communication systems including OC-192/STM-64 and 10 Gigabit Ethernet (10 GbE).

The Si57x consists of a digitally-controlled oscillator (DCO) based on Silicon Laboratories' third-generation DSPLL technology, which is driven by an internal fixed-frequency crystal reference.

The device's default output frequency is set at the factory and can be reprogrammed through the two-wire I^{2}C serial port. Once the device is powered down, it will return to its factory-set default output frequency.

While the Si570 outputs a fixed frequency, the Si571 has a pullable output frequency using the voltage control input pin. This makes the Si571 an ideal choice for high-performance, low-jitter, phase-locked loops.

3.1. Programming a New Output Frequency

The output frequency (f_{out}) is determined by programming the DCO frequency (f_{DCO}) and the device's output dividers (HS_DIV, N1). The output frequency is calculated using the following equation:

$$f_{out} = \frac{f_{DCO}}{\text{Output Dividers}} = \frac{f_{XTAL} \times \text{RFREQ}}{\text{HSDIV} \times \text{N1}}$$

The DCO frequency is adjustable in the range of 4.85 to 5.67 GHz by setting the high-resolution 38-bit fractional multiplier (RFREQ). The DCO frequency is the product of the internal fixed-frequency crystal (f_{XTAL}) and RFREQ.

The 38-bit resolution of RFREQ allows the DCO frequency to have a programmable frequency resolution of 0.09 ppb.

As shown in Figure 3, the device allows reprogramming of the DCO frequency up to ±3500 ppm from the center frequency configuration without interruption to the output clock. Changes greater than the ±3500 ppm window will cause the device to recalibrate its internal tuning circuitry, forcing the output clock to momentarily stop and start at any arbitrary point during a clock cycle. This re-calibration process establishes a new center frequency and can take up to 10 ms. Circuitry receiving a clock from the Si57x device that is sensitive to glitches or runt pulses may have to be reset once the recalibration process is complete.

3.1.1. Reconfiguring the Output Clock for a Small Change in Frequency

For output changes less than ±3500 ppm from the center frequency configuration, the DCO frequency is the only value that needs reprogramming. Since $f_{DCO} = f_{XTAL} \times \text{RFREQ}$, and that f_{XTAL} is fixed, changing the DCO frequency is as simple as reconfiguring the RFREQ value as outlined below:

1. Using the serial port, read the current RFREQ value (registers 0x08–0x12).
2. Calculate the new value of RFREQ given the change in frequency.

$$\text{RFREQ}_{new} = \text{RFREQ}_{current} \times \frac{f_{out\_new}}{f_{out\_current}}$$

3. Using the serial port, write the new RFREQ value (registers 0x08—0x12).

Example:

An Si570 generating a 148.35 MHz clock must be reconfigured "on-the-fly" to generate a 148.5 MHz clock. This represents a change of +1011.122 ppm, which is well within the ±3500 ppm window.

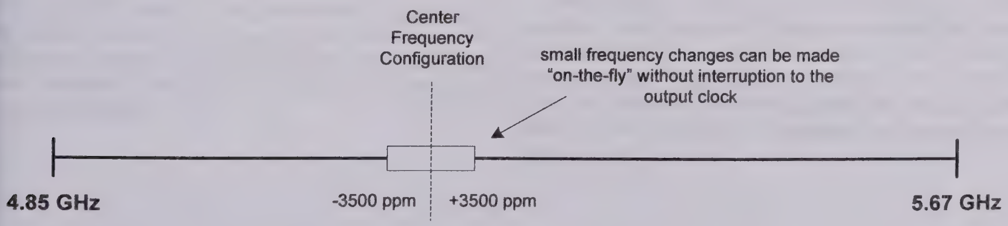

Center
Frequency
Configuration
small frequency changes can be made "on-the-fly" without interruption to the output clock
4.85 GHz
-3500 ppm
+3500 ppm
5.67 GHz

Figure 3. DCO Frequency Range

A typical frequency configuration for this example:

$RFREQ_{current}$ = 0x2EBB04CE0

$F_{out\_current}$ = 148.35 MHz

F_{out_new} = 148.50 MHz

Calculate $RFREQ_{new}$ to change the output frequency from 148.35 MHz to 148.5 MHz:

$$RFREQ_{new} = 0x2EBB04CE0 \times \frac{148.50\text{ MHz}}{148.35\text{ MHz}}$$
$$= 0x2EC71D666$$

Note that performing calculations with RFREQ requires a minimum of 38-bit arithmetic precision.

3.1.2. Reconfiguring the Output Clock for Large Changes in Output Frequency

For output frequency changes outside of ±3500 ppm from the center frequency, it is likely that both the DCO frequency and the output dividers need to be reprogrammed. Note that changing the DCO frequency outside of the ±3500 ppm window will cause the output to momentarily stop and restart at any arbitrary point in a clock cycle. Devices sensitive to glitches or runt pulses may have to be reset once reconfiguration is complete.

The process for reconfiguring the output frequency outside of a ±3500 ppm window is shown below:

1. Using the serial port, read the current values for RFREQ, HSDIV, and N1.
2. Calculate f_{XTAL} for the device. Note that because of slight variations of the internal crystal frequency from one device to another, each device may have a different RFREQ value or possibly even different HSDIV or N1 values to maintain the same output frequency. It is necessary to calculate f_{XTAL} for each device.

$$f_{XTAL} = \frac{F_{out} \times HSDIV \times N1}{RFREQ}$$

Once f_{XTAL} has been determined, new values for RFREQ, HSDIV, and N1 are calculated to generate a new output frequency (f_{out_new}). New values can be calculated manually or with the Si57x-EVB software, which provides a user-friendly application to help find the optimum values.

The first step in manually calculating the frequency configuration is to determine new frequency divider values (HSDIV, N1). Given the desired output frequency (fout_new), find the frequency divider values that will keep the DCO oscillation frequency in the range of 4.85 to 5.67 GHz.

$$f_{DCO\_new} = f_{out\_new} \times HSDIV_{new} \times N1_{new}$$

Valid values of HSDIV are 4, 5, 6, 7, 9 or 11. N1 can be selected as 1 or any even number up to 128 (i.e. 1, 2, 4, 6, 8, 10 ... 128). To help minimize the device's power consumption, the divider values should be selected to keep the DCO's oscillation frequency as low as possible. The lowest value of N1 with the highest value of HS_DIV also results in the best power savings.

Once HS_DIV and N1 have been determined, the next step is to calculate the reference frequency multiplier (RFREQ).

$$RFREQ_{new} = \frac{f_{DCO\_new}}{f_{XTAL}}$$

RFREQ is programmable as a 38-bit binary fractional frequency multiplier with the first 10 most significant bits (MSBs) representing the integer portion of the multiplier, and the 28 least significant bits (LSBs) representing the fractional portion.

Before entering a fractional number into the RFREQ register, it must be converted to a 38-bit integer using a bitwise left shift operation by 28 bits, which effectively multiplies RFREQ by 2^{28}.

Example:

RFREQ = 46.043042064d

Multiply RFREQ by 2^{28} = 12359584992.1

Discard the fractional portion = 12359584992

Convert to hexadecimal = 02E0B04CE0h

In the example above, the multiplication operation requires 38-bit precision. If 38-bit arithmetic precision is not available, then the fractional portion can be separated from the integer and shifted to the left by 28-bits. The result is concatenated with the integer portion to form a full 38-bit word. An example of this operation is shown in Figure 4.

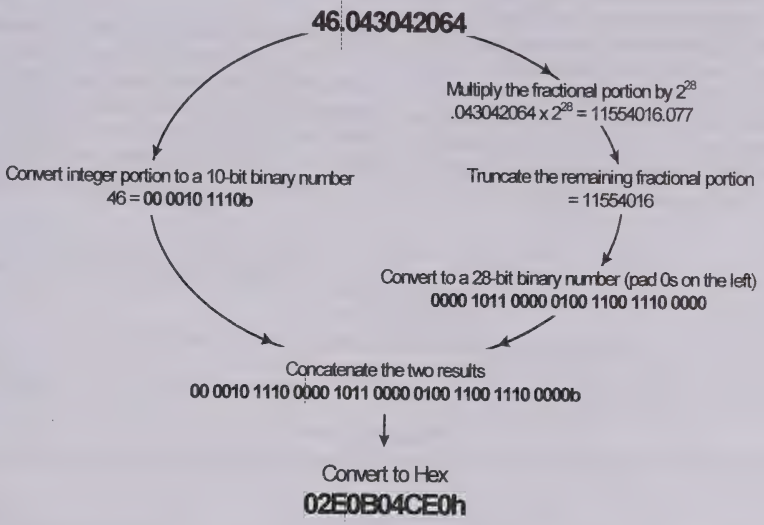

46.043042064
Multiply the fractional portion by 2^{28}
$.043042064 \times 2^{28} = 11554016.077$
Truncate the remaining fractional portion
= 11554016
Convert to a 28-bit binary number (pad 0s on the left)
0000 1011 0000 0100 1100 1110 0000
Convert integer portion to a 10-bit binary number
46 = 00 0010 1110b
Concatenate the two results
00 0010 1110 0000 1011 0000 0100 1100 1110 0000b
Convert to Hex
02E0B04CE0h

Figure 4. Example of RFREQ Decimal to Hexadecimal Conversion

Once the new values for RFREQ, HSDIV, and N1 are determined, they can be written directly into the device from the serial port using the following procedure:

1. Freeze the DCO (bit 4 of Register 137)
2. Write the new frequency configuration (RFREQ, HS_DIV, N1)
3. Unfreeze the DCO and assert the NewFreq bit (bit 6 of Register 135) within the maximum delay specified in Table 12, "Programming Constraints and Timing," on page 12.

The process of freezing and unfreezing the DCO will cause the output clock to momentarily stop and start at any arbitrary point during a clock cycle. This process can take up to 10 ms. Circuitry that is sensitive to glitches or runt pulses may have to be reset after the new frequency configuration is written.

Example:

An Si570 generating 156.25 MHz must be re-configured to generate a 161.1328125 MHz clock (156.25 MHz x 66/64). This frequency change is greater than ±3500 ppm.

f_{out} = 156.25 MHz

Read the current values for RFREQ, HS_DIV, N1:

$RFREQ_{current}$ = 0x2BC011EB8h = 11744124600d,

11744124600d x 2^{28} = 43.7502734363d

HS_DIV = 4

N1 = 8

Calculate f_{XTAL}, $f_{DCO\_current}$

$$f_{DCO\_current} = f_{out} \times HSDV \times N1 = 5.000000000\ \text{GHz}$$

$$f_{XTAL} = \frac{f_{DCO\_current}}{RFREQ_{current}} = 114.285\ \text{MHz}$$

Given f_{out_new} = 161.1328125 MHz, choose output dividers that will keep f_{DCO} within the range of 4.85 to 5.67 GHz. In this case, keeping the same output dividers will still keep f_{DCO} within its range limits:

$$f_{DCO\_new} = f_{out\_new} \times HSDV_{new} \times N1_{new}$$

$$= 161.1328125\ \text{MHz} \times 4 \times 8 = 5.156250000\ \text{GHz}$$

Calculate the new value of RFREQ given the new DCO frequency:

$$RFREQ_{new} = \frac{f_{DCO\_new}}{f_{XTAL}} = 45.11746934$$

= 0x2D1E12788

3.2. I^{2}C Interface

The control interface to the Si570 is an I^{2}C-compatible 2-wire bus for bidirectional communication. The bus consists of a bidirectional serial data line (SDA) and a serial clock input (SCL). Both lines must be connected to the positive supply via an external pullup.Fast mode operation is supported for transfer rates up to 400 kbps as specified in the I^{2}C-Bus Specification standard.

Figure 5 shows the command format for both read and write access. Data is always sent MSB. Data length is 1 byte. Read and write commands support 1 or more data bytes as illustrated. The master must send a Not Acknowledge and a Stop after the last read data byte to terminate the read command. The timing specifications and timing diagram for the I2C bus can be found in the I2C-Bus Specification standard (fast mode operation). The device I2C address is specified in the part number.

S	Slave Address	0	A	Byte Address	A	Data	A	Data	A	P

Write Command
(Optional 2nd data byte and acknowledge illustrated)

S	Slave Address	0	A	Byte Address	A	S	Slave Address	1	A	Data	A	Data	N	P

Read Command
(Optional data byte and acknowledge before the last data byte and not acknowledge illustrated)

☐ From master to slave ☐ From slave to master

A – Acknowledge (SDA LOW)
N – Not Acknowledge (SDA HIGH).
Required after the last data byte to signal the end of the read comand to the slave.
S – START condition
P – STOP condition

Figure 5. I^{2}C Command Format

4. Serial Port Registers

Note: Any register not listed here is reserved and must not be written. All bits are R/W unless otherwise noted.

Register	Name	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
7	High Speed/ N1 Dividers	HS_DIV[2:0]			N1[6:2]				
8	Reference Frequency	N1[1:0]		RFREQ[37:32]					
9	Reference Frequency	RFREQ[31:24]							
10	Reference Frequency	RFREQ[23:16]							
11	Reference Frequency	RFREQ[15:8]							
12	Reference Frequency	RFREQ[7:0]							
135	Reset/Memory Control	RST_REG	NewFreq						RECALL
137	Freeze DCO				Freeze DCO				

Register 7. High Speed/N1 Dividers

Bit	D7	D6	D5	D4	D3	D2	D1	D0
Name	HS_DIV[2:0]			N1[6:2]				
Type	R/W			R/W				

Bit	Name	Function
7:5	HS_DIV[2:0]	**DCO High Speed Divider.** Sets value for high speed divider that takes the DCO output f_{OSC} as its clock input. 000 = 4 001 = 5 010 = 6 011 = 7 100 = Not used. 101 = 9 110 = Not used. 111 = 11
4:0	N1[6:2]	**CLKOUT Output Divider.** Sets value for CLKOUT output divider. Allowed values are [1] and [2, 4, 6, ..., 2^7]. Illegal odd divider values will be rounded up to the nearest even value. The value for the N1 register can be calculated by taking the divider ratio minus one. For example, to divide by 10, write 0001001 (9 decimal) to the N1 registers. 0000000 = 1 1111111 = 2^7

egister 8. Reference Frequency

Bit	D7	D6	D5	D4	D3	D2	D1	D0
Name	N1[1:0]		RFREQ[37:32]					
Type	R/W		R/W					

Bit	Name	Function
7:6	N1[1:0]	**CLKOUT Output Divider.** Sets value for CLKOUT output divider. Allowed values are [1, 2, 4, 6, ..., 2^7]. Illegal odd divider values will be rounded up to the nearest even value. The value for the N1 register can be calculated by taking the divider ratio minus one. For example, to divide by 10, write 0001001 (9 decimal) to the N1 registers. 0000000 = 1 1111111 = 2^7
5:0	RFREQ[37:32]	**Reference Frequency.** Frequency control input to DCO.

Register 9. Reference Frequency

Bit	D7	D6	D5	D4	D3	D2	D1	D0
Name	RFREQ[31:24]							
Type	R/W							

Bit	Name	Function
7:0	RFREQ[31:24]	**Reference Frequency.** Frequency control input to DCO.

Register 10. Reference Frequency

Bit	D7	D6	D5	D4	D3	D2	D1	D0
Name	RFREQ[23:16]							
Type	R/W							

Bit	Name	Function
7:0	RFREQ[23:16]	**Reference Frequency.** Frequency control input to DCO.

Register 11. Reference Frequency

Bit	D7	D6	D5	D4	D3	D2	D1	D0
Name	RFREQ[15:8]							
Type	R/W							

Bit	Name	Function
7:0	RFREQ[15:8]	**Reference Frequency.** Frequency control input to DCO.

Register 12. Reference Frequency

Bit	D7	D6	D5	D4	D3	D2	D1	D0
Name	RFREQ[7:0]							
Type	R/W							

Bit	Name	Function
7:0	RFREQ[7:0]	**Reference Frequency.** Frequency control input to DCO.

Register 135. Reset/Memory Control

Bit	D7	D6	D5	D4	D3	D2	D1	D0
Name	RST_REG	NewFreq	N/A					RECALL
Type	R/W	R/W	R/W					R/W

Reset settings = 00xx xx00

Bit	Name	Function
7	RST_REG	**Internal Reset.** 0 = Normal operation. 1 = Reset of all internal logic. Output tristated during reset. Upon completion of internal logic reset, RST_REG is internally reset to zero.
6	NewFreq	**New frequency applied.** Alerts the DSPLL that a new frequency configuration has been applied. This bit will clear itself when the new frequency is applied.
5:1	N/A	**Always zero.**
0	RECALL	**Recall NVM into RAM.** 0 = No operation. 1 = Write NVM bits into RAM. Bit is internally reset following completion of operation.

Register 137. Freeze DCO

Bit	D7	D6	D5	D4	D3	D2	D1	D0
Name				Freeze DCO				
Type	R/W							

Reset settings = 00xx xx00

Bit	Name	Function
7:5	Reserved	
4	Freeze DCO	**Freeze DCO.** Freezes the DSPLL so the frequency configuration can be modified.
3:0	Reserved	

5. Si570 (XO) Pin Descriptions

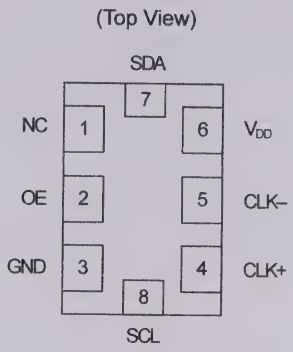


Table 13. Si570 Pin Descriptions

Pin	Name	Type	Function
1	NC	N/A	No Connect. Make no external connection to this pin.
2	OE	Input	Output Enable: See "7. Ordering Information" on page 24.
3	GND	Ground	Electrical and Case Ground.
4	CLK+	Output	Oscillator Output.
5	CLK– (NC for CMOS*)	Output (N/A for CMOS*)	Complementary Output. (NC for CMOS*).
6	V_{DD}	Power	Power Supply Voltage.
7	SDA	Bidirectional Open Drain	I^2C Serial Data.
8	SCL	Input	I^2C Serial Clock.

***Note:** CMOS output option only: make no external connection to this pin.

6. Si571 (VCXO) Pin Descriptions

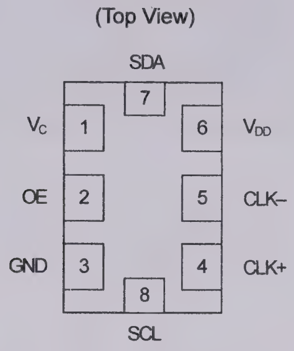


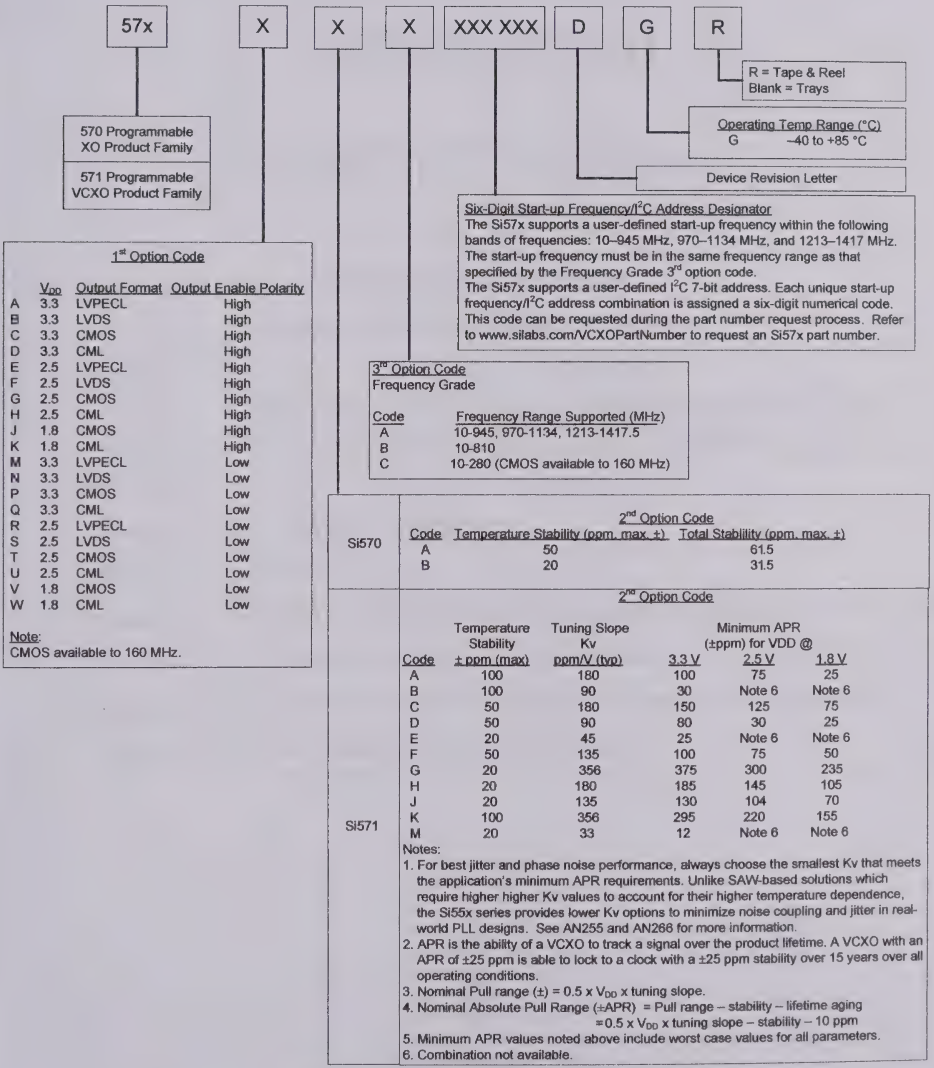
Table 14. Si571 Pin Descriptions

Pin	Name	Type	Function
1	V_C	Analog Input	Control Voltage
2	OE	Input	Output Enable: See "7. Ordering Information" on page 24.
3	GND	Ground	Electrical and Case Ground
4	CLK+	Output	Oscillator Output
5	CLK– (NC for CMOS*)	Output (N/A for CMOS*)	Complementary Output. (NC for CMOS*).
6	V_{DD}	Power	Power Supply Voltage
7	SDA	Bidirectional Open Drain	I^2C Serial Data
8	SCL	Input	I^2C Serial Clock

***Note:** CMOS output option only: make no external connection to this pin.

7. Ordering Information

The Si570/Si571 supports a wide variety of options including frequency range, start-up frequency, temperature stability, tuning slope, output format, and V_{DD}. Specific device configurations are programmed into the Si570/Si571 at time of shipment. Configurations are specified using the Part Number Configuration chart shown below. Silicon Labs provides a web browser-based part number configuration utility to simplify this process. Refer to to access this tool and for further ordering instructions. The Si570/Si571 XO/VCXO series is supplied in an industry-standard, RoHS compliant, 8-pad, 5 x 7 mm package. Tape and reel packaging is an ordering option.



570 Programmable XO Product Family

571 Programmable VCXO Product Family

R = Tape & Reel
Blank = Trays

Operating Temp Range (°C)

G	–40 to +85 °C

Device Revision Letter

Six-Digit Start-up Frequency/I^{2}C Address Designator
The Si57x supports a user-defined start-up frequency within the following bands of frequencies: 10–945 MHz, 970–1134 MHz, and 1213–1417 MHz. The start-up frequency must be in the same frequency range as that specified by the Frequency Grade 3rd option code.
The Si57x supports a user-defined I^{2}C 7-bit address. Each unique start-up frequency/I^{2}C address combination is assigned a six-digit numerical code. This code can be requested during the part number request process. Refer to www.silabs.com/VCXOPartNumber to request an Si57x part number.

1st Option Code

	V_{DD}	Output Format	Output Enable Polarity
A	3.3	LVPECL	High
B	3.3	LVDS	High
C	3.3	CMOS	High
D	3.3	CML	High
E	2.5	LVPECL	High
F	2.5	LVDS	High
G	2.5	CMOS	High
H	2.5	CML	High
J	1.8	CMOS	High
K	1.8	CML	High
M	3.3	LVPECL	Low
N	3.3	LVDS	Low
P	3.3	CMOS	Low
Q	3.3	CML	Low
R	2.5	LVPECL	Low
S	2.5	LVDS	Low
T	2.5	CMOS	Low
U	2.5	CML	Low
V	1.8	CMOS	Low
W	1.8	CML	Low

Note:
CMOS available to 160 MHz.

3rd Option Code
Frequency Grade

Code	Frequency Range Supported (MHz)
A	10-945, 970-1134, 1213-1417.5
B	10-810
C	10-280 (CMOS available to 160 MHz)

Si570

2nd Option Code

Code	Temperature Stability (ppm, max, ±)	Total Stablility (ppm, max, ±)
A	50	61.5
B	20	31.5

Si571

2nd Option Code

Code	Temperature Stability ± ppm (max)	Tuning Slope Kv ppm/V (typ)	Minimum APR (±ppm) for VDD @ 3.3 V	2.5 V	1.8 V
A	100	180	100	75	25
B	100	90	30	Note 6	Note 6
C	50	180	150	125	75
D	50	90	80	30	25
E	20	45	25	Note 6	Note 6
F	50	135	100	75	50
G	20	356	375	300	235
H	20	180	185	145	105
J	20	135	130	104	70
K	100	356	295	220	155
M	20	33	12	Note 6	Note 6

Notes:
1. For best jitter and phase noise performance, always choose the smallest Kv that meets the application's minimum APR requirements. Unlike SAW-based solutions which require higher higher Kv values to account for their higher temperature dependence, the Si55x series provides lower Kv options to minimize noise coupling and jitter in real-world PLL designs. See AN255 and AN266 for more information.
2. APR is the ability of a VCXO to track a signal over the product lifetime. A VCXO with an APR of ±25 ppm is able to lock to a clock with a ±25 ppm stability over 15 years over all operating conditions.
3. Nominal Pull range (±) = 0.5 x V_{DD} x tuning slope.
4. Nominal Absolute Pull Range (±APR) = Pull range – stability – lifetime aging
   = 0.5 x V_{DD} x tuning slope – stability – 10 ppm
5. Minimum APR values noted above include worst case values for all parameters.
6. Combination not available.

Figure 6. Part Number Convention

8. Si57x Mark Specification

Figure 7 illustrates the mark specification for the Si57x. Table 15 lists the line information.

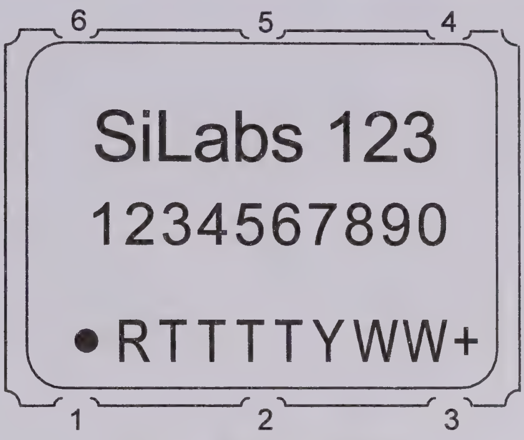


Figure 7. Mark Specification

Table 15. Si57x Top Mark Description

Line	Position	Description
1	1–10	“SiLabs”+ Part Family Number, 5xx (First 3 characters in part number)
2	1–10	Si570, Si571: Option1 + Option2 + Option3 + ConfigNum(6) + Temp
3	**Trace Code**	
	Position 1	Pin 1 orientation mark (dot)
	Position 2	Product Revision (D)
	Position 3–6	Tiny Trace Code (4 alphanumeric characters per assembly release instructions)
	Position 7	Year (least significant year digit), to be assigned by assembly site (ex: 2007 = 7)
	Position 8–9	Calendar Work Week number (1–53), to be assigned by assembly site
	Position 10	“+” to indicate Pb-Free and RoHS-compliant

9. Outline Diagram and Suggested Pad Layout

Figure 8 illustrates the package details for the Si570/Si571. Table 16 lists the values for the dimensions shown in the illustration.

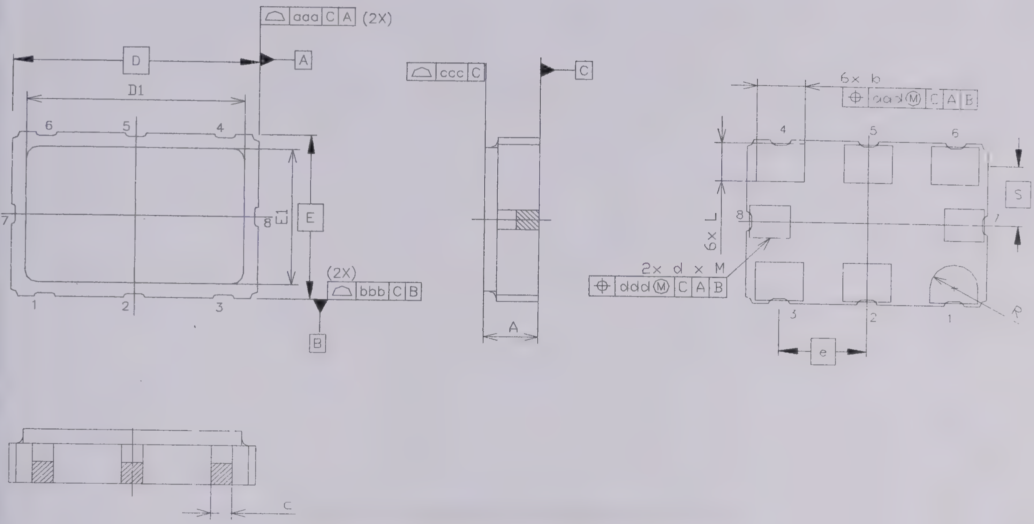


Figure 8. Si570/Si571 Outline Diagram

Table 16. Package Diagram Dimensions (mm)

Dimension	Min	Nom	Max
A	1.45	1.65	1.85
b	1.2	1.4	1.6
c	0.60 TYP		
d	0.97	1.17	1.37
D	7.00 BSC		
D1	6.10	6.2	6.30
e	2.54 BSC		
E	5.00 BSC		
E1	4.30	4.40	4.50
L	1.07	1.27	1.47
M	0.8	1.0	1.2
S	1.815 BSC		
R	0.7 REF		
aaa	—	—	0.15
bbb	—	—	0.15
ccc	—	—	0.10
ddd	—	—	0.10

10. 8-Pin PCB Land Pattern

Figure 9 illustrates the 8-pin PCB land pattern for the Si570/Si571. Table 17 lists the values for the dimensions shown in the illustration.

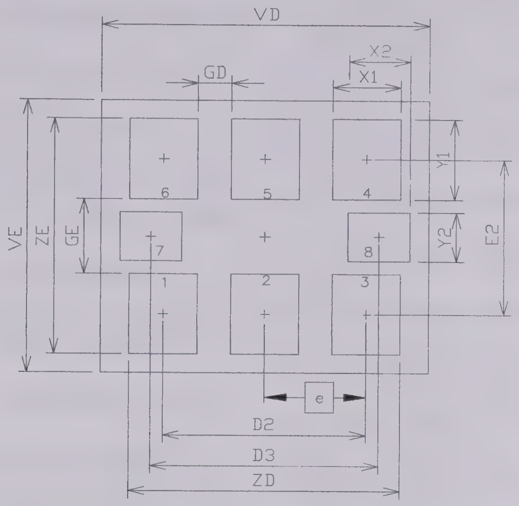


Figure 9. Si570/Si571 PCB Land Pattern

Table 17. PCB Land Pattern Dimensions (mm)

Dimension	Min	Max
D2	5.08 REF	
D3	5.705 REF	
e	2.54 BSC	
E2	4.20 REF	
GD	0.84	—
GE	2.00	—
VD	8.20 REF	
VE	7.30 REF	
X1	1.70 TYP	
X2	1.545 TYP	
Y1	2.15 REF	
Y2	1.3 REF	
ZD	—	6.78
ZE	—	6.30

Note:

1. Dimensioning and tolerancing per the ANSI Y14.5M-1994 specification.
2. Land pattern design follows IPC-7351 guidelines.
3. All dimensions shown are at maximum material condition (MMC).
4. Controlling dimension is in millimeters (mm).

DOCUMENT CHANGE LIST

Revision 0.1 to Revision 0.2

- Updated " Description" on page 1.
- Updated "1. Detailed Block Diagrams" on page 4 for both XO and VCXO.
- Updated the Nominal Control Voltage in Table 2, "V_C Control Voltage Input," on page 5.
- Updated tables to reflect slight performance differences between Si570 and Si571.
- Added detail to the "3.2. I2C Interface" on page 16.
- Revised "3.2.3. Programming Procedure" on page 12.
  - Procedure now requires use of two frequency configuration register sets.
  - Procedure now recommends disabling output at powerup to protect equipment not expecting the default output frequency.
- Added second frequency configuration register set to the register tables.
- Added frequency configuration select register.
- Updated "7. Ordering Information" on page 24 to be consistent with the Si55x series devices.

Revision 0.2 to Revision 0.3

- Updated Table 1, "Recommended Operating Conditions," on page 5.
  - Device maintains stable operation over –40 to +85 °C operating temperature range.
  - Supply current specifications updated.
- Updated Table 4, "CLK± Output Levels and Symmetry," on page 7.
  - Updated LVDS differential peak-peak swing specifications.
- Updated Table 5, "CLK± Output Phase Jitter (Si570)," on page 7.
- Updated Table 6, "CLK± Output Phase Jitter (Si571)," on page 8.
- Updated Table 7, "CLK± Output Period Jitter," on page 10.
  - Revised period jitter specifications.
- Updated Table 10, "Absolute Maximum Ratings," on page 11 to reflect the soldering temperature time at 260 °C is 20–40 sec per JEDEC J-STD-020C.
- Updated device programming procedure in Section "3.2.3. Programming Procedure" on page 12.
- Updated "7. Ordering Information" on page 24.
  - Changed ordering instructions to revision D.
- Added "8. Si57x Mark Specification" on page 25.

Revision 0.3 to Revision 0.31

- Updated "3.2.3. Programming Procedure" on page 12.
  - Corrected Step 6 to read "bit 4".
- Corrected Freeze DCO bit location in Register 137 to bit 4 on pages 14 and 18.

Revision 0.31 to Revision 1.0

- Updated " Functional Block Diagram" on page 1.
- Updated Figure 1, "Si570 Detailed Block Diagram," on page 4.
- Updated Figure 2, "Si571 Detailed Block Diagram," on page 4.
- Updated Figure 6, "Part Number Convention," on page 24.
- Updated Table 1, "Recommended Operating Conditions," on page 5.
- Updated Table 3, "CLK± Output Frequency Characteristics," on page 6.
- Updated Table 6, "CLK± Output Phase Jitter (Si571)," on page 8.
- Updated Table 12, "Programming Constraints and Timing," on page 12.
- Updated Table 12, "Programming Constraints and Timing," on page 12.
- Updated "3. Functional Description" on page 13.
- Updated "3.1. Programming a New Output Frequency" on page 13.
- Updated "3.1.1. Reconfiguring the Output Clock for a Small Change in Frequency" on page 13.
- Updated "3.1.2. Reconfiguring the Output Clock for Large Changes in Output Frequency" on page 14.
- Updated "7.Ordering Information".
  - Updated Figure 6, "Part Number Convention," on page 24.

Revision 1.0 to Revision 1.1

- Restored programming constraint information on page 15 and in Table 12, page 12.
- Clarified NC (No Connect) pin designations in Tables 13–14 on pages 22–23.

NOTES:

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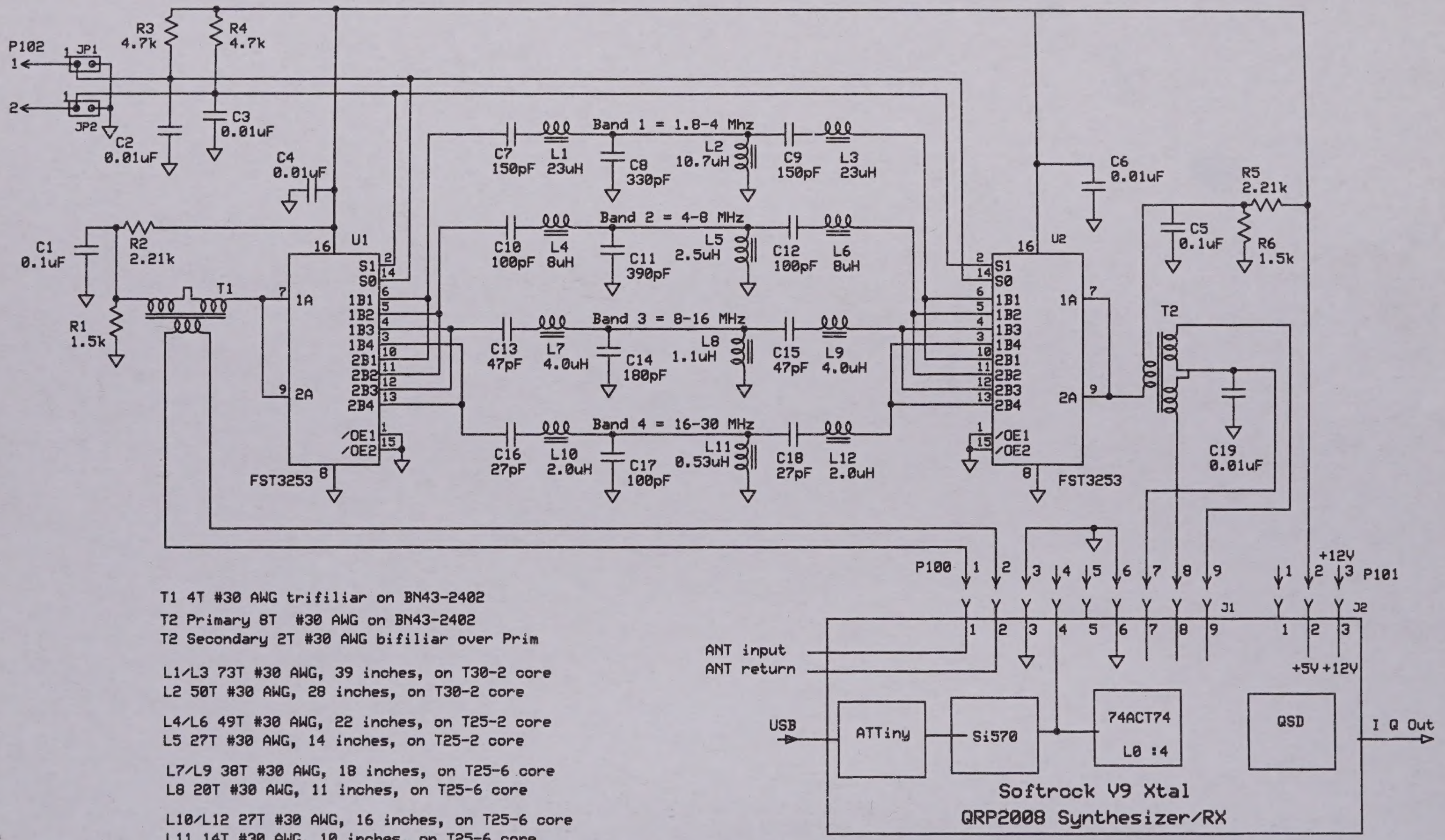
SOFTROCK V9 GENERAL COVERAGE PRESELECTORS 1.8 MHz - 30 MHz

Band 1 = 1.8 - 4 Mhz
Band 2 = 4 - 8 MHz
Band 3 = 8 - 16 MHz
Band 4 = 16 - 30 MHz



T1 4T #30 AWG trifiliar on BN43-2402
T2 Primary 8T #30 AWG on BN43-2402
T2 Secondary 2T #30 AWG bifiliar over Prim

L1/L3 73T #30 AWG, 39 inches, on T30-2 core
L2 50T #30 AWG, 28 inches, on T30-2 core

L4/L6 49T #30 AWG, 22 inches, on T25-2 core
L5 27T #30 AWG, 14 inches, on T25-2 core

L7/L9 38T #30 AWG, 18 inches, on T25-6 core
L8 20T #30 AWG, 11 inches, on T25-6 core

L10/L12 27T #30 AWG, 16 inches, on T25-6 core
L11 14T #30 AWG, 10 inches, on T25-6 core

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Softrock V9 BPF Daughter Board
Jan G0BBL
V1.1